Iowa Water Quality

2003 Regional Meetings

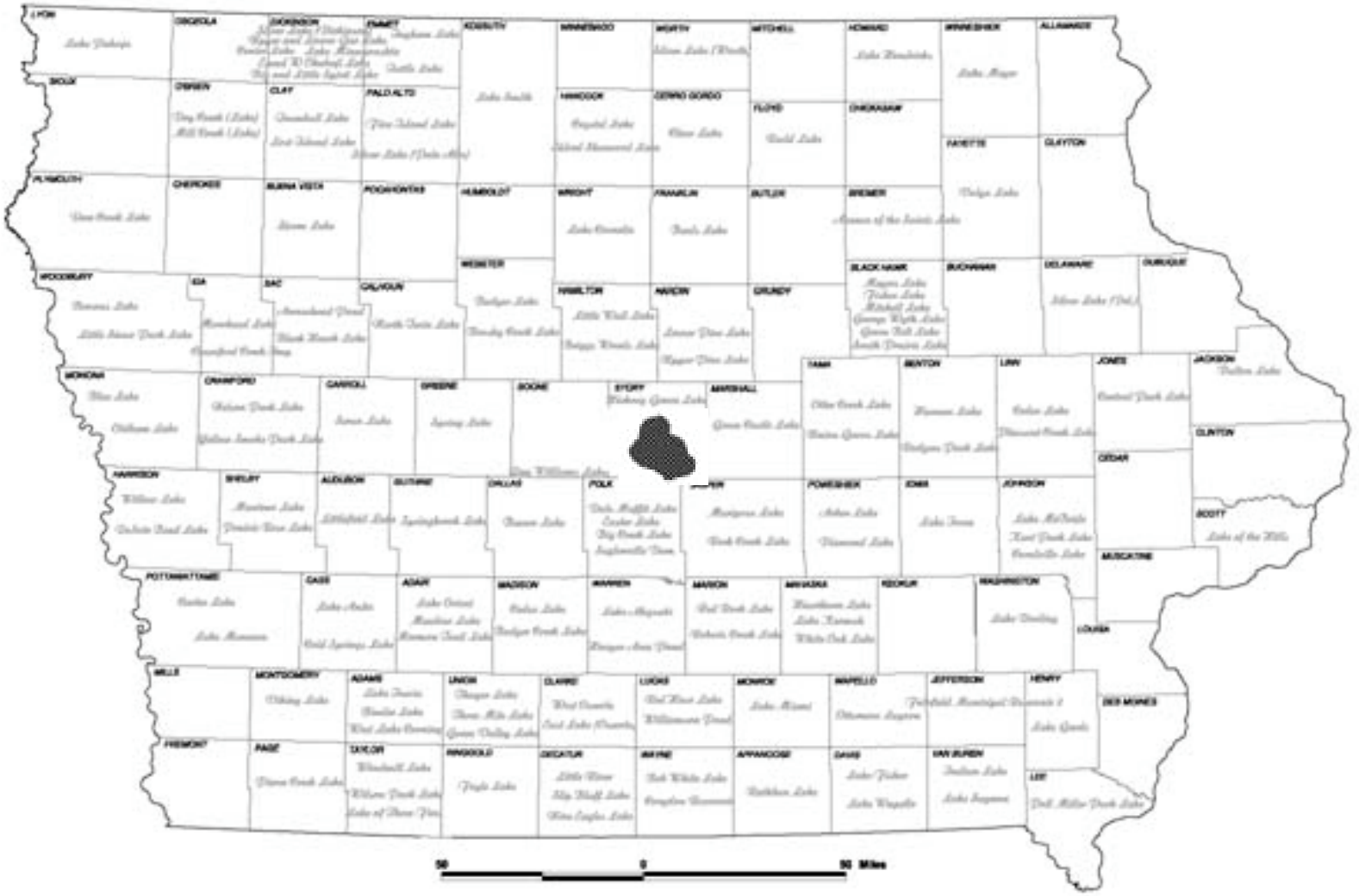
Iowa's Water Resources

- Rivers & Streams
  - Perennial streams - 26,630 miles
  - Intermittent streams - 42,957 miles
  - Border rivers - 660 miles

Iowa's Water Resources

- Lakes, reservoirs, ponds & wetlands
  - 5,432 water bodies
  - 161,366 acres

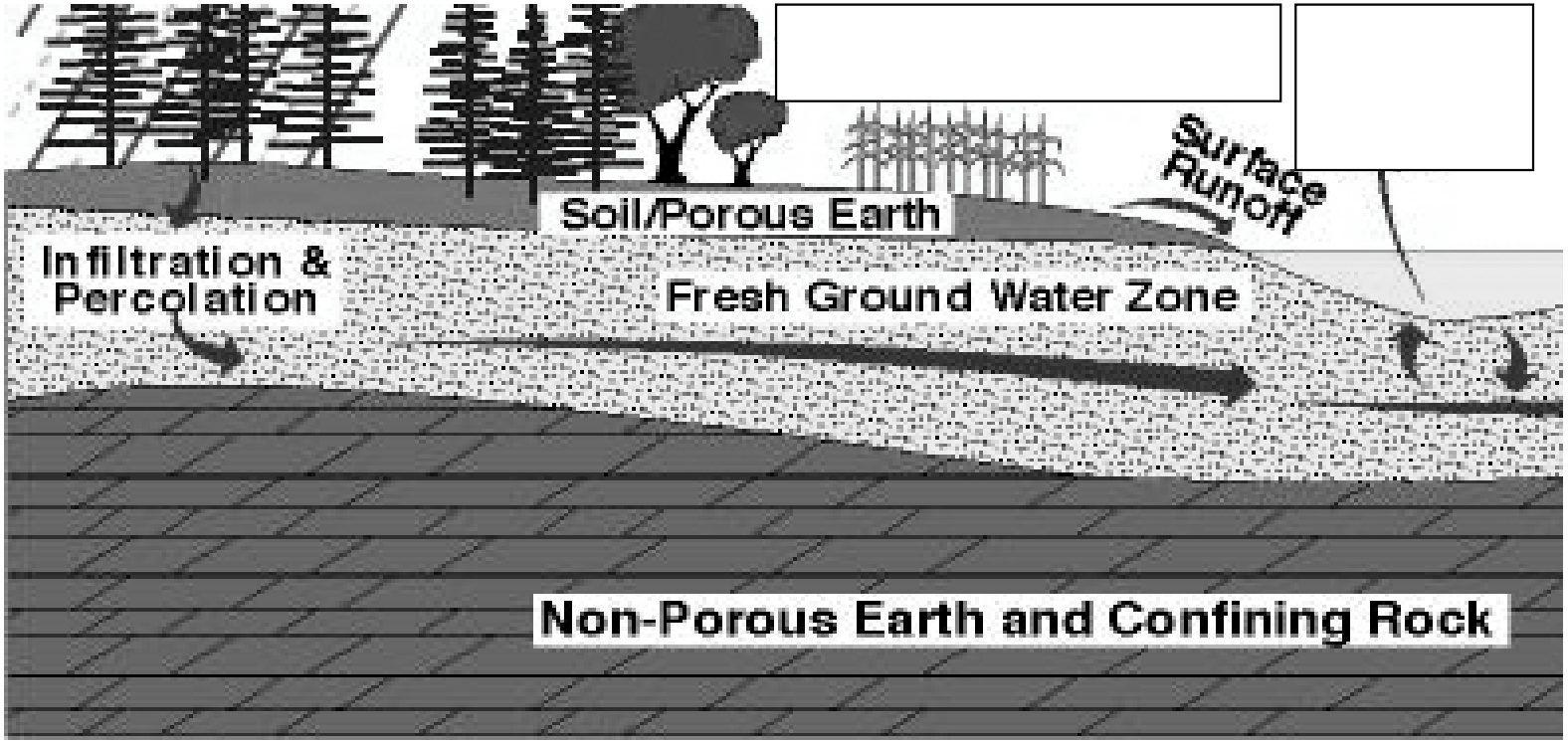
If All of Our Public Lakes...



Were in Just One Spot

Groundwater - our underground lakes

- Ground water quantity and quality varies across the state

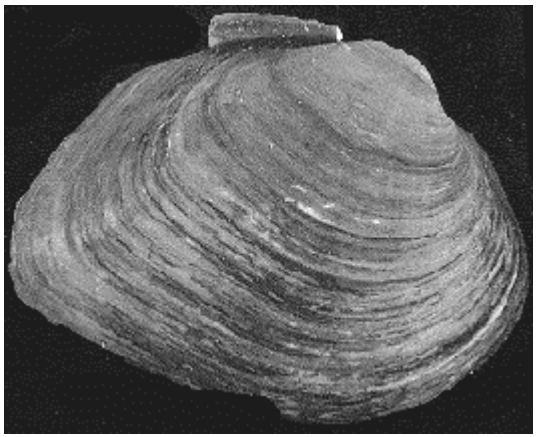


Shallow aquifers are more vulnerable to

Iowa is considered a "water rich" state, but …

- Not a lot of surface water - lakes, streams and rivers
- Groundwater resources - often limited
  - quantity
  - quality
- Water recreation and availability - important
  - quality of life
  - economic development
- It pays to protect and improve

Everyone Wants Clean Water

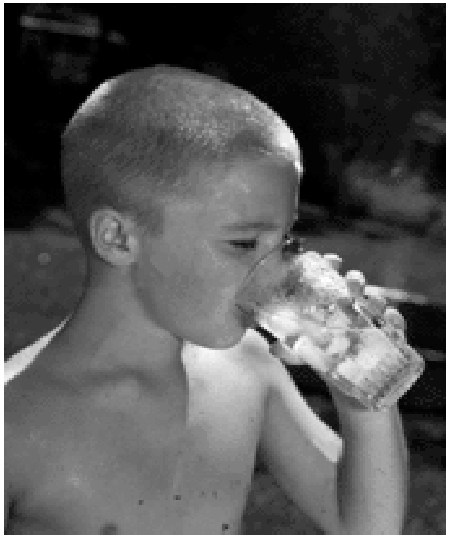


But what does “clean” mean?

Not all people agree what makes good water quality

A drinking water plant operator…..

- Able to meet drinking water standards (MCLs) with conventional treatment
- Should not have to use expensive treatment such as nitrate removal



A swimmer…

- Clear water
- Low risk of getting sick from swallowing or contact

Angler…

- Plentiful and diverse supply of game fish

Even the professionals have differing opinions of good and bad water quality

John Olson, DNR water quality staff

What water body represents the best water quality in Iowa and why?

If forced to choose one river as having the "best" water quality, I would pick the West Fork Cedar River in Butler and Franklin counties. In terms of chemical, physical and biological quality, this river appears better than most.

Richard Kelley,
Hygienic Lab

What body of water represents the worst water quality in Iowa and why?

Just about every interior stream in the State.

Dr. Roy Overton

What body of water represents the worst water quality in Iowa and why?

Probably the Mississippi River.... It carries the nitrates to the Gulf and when we track cancer of the kidneys and bladder it reflects the increased pollution of the river.

Richard Kelley, Hygienic Lab

What body of water represents the best water quality in Iowa and why?

The answer I want to give…….is the Mississippi. The Mississippi supports a larger, more diverse population than any other body of water in the State.

… Perhaps, it's not the best water quality as much as it has the greatest potential.

If even the experts can't agree, how do we measure "good" versus "bad" water quality

Two tools for evaluating water quality

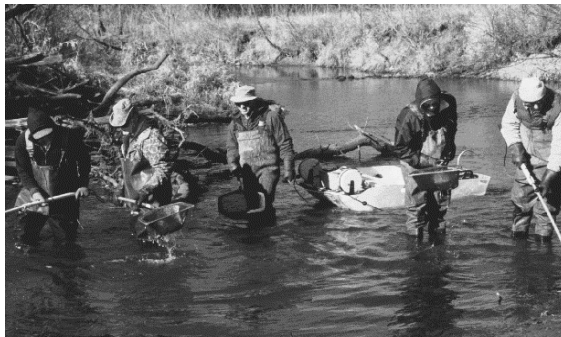
- Monitoring
- Water quality standards

Chemical & physical analysis

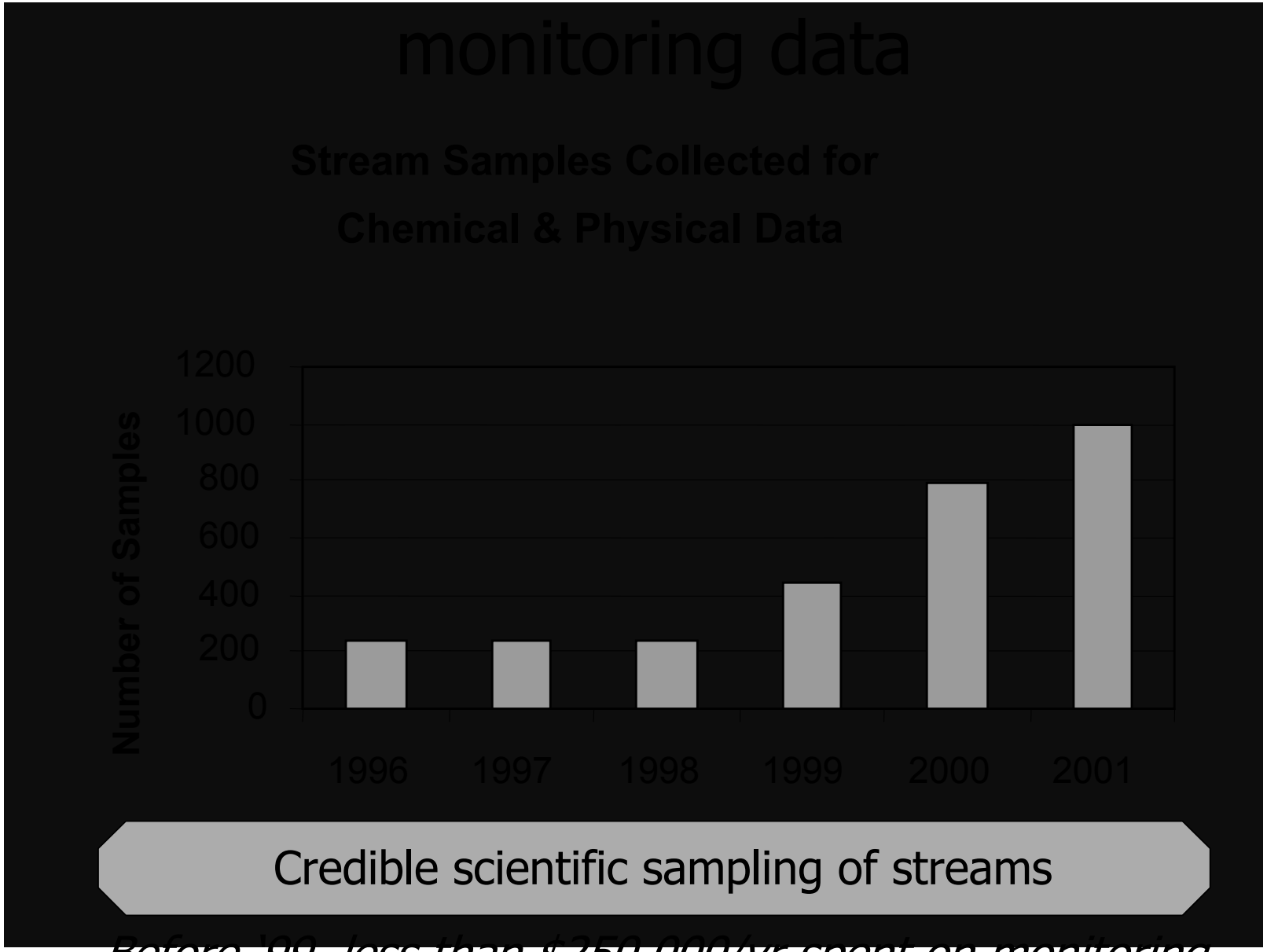
- Temperature, dissolved oxygen, pH, suspended solids
- Chemical analysis - ammonia, pesticides, chemicals, bacteria, etc.

Biological analysis

- Measuring the "aquatic health"
- Fish numbers and diversity
- Aquatic "bugs"
- Fish tissue testing



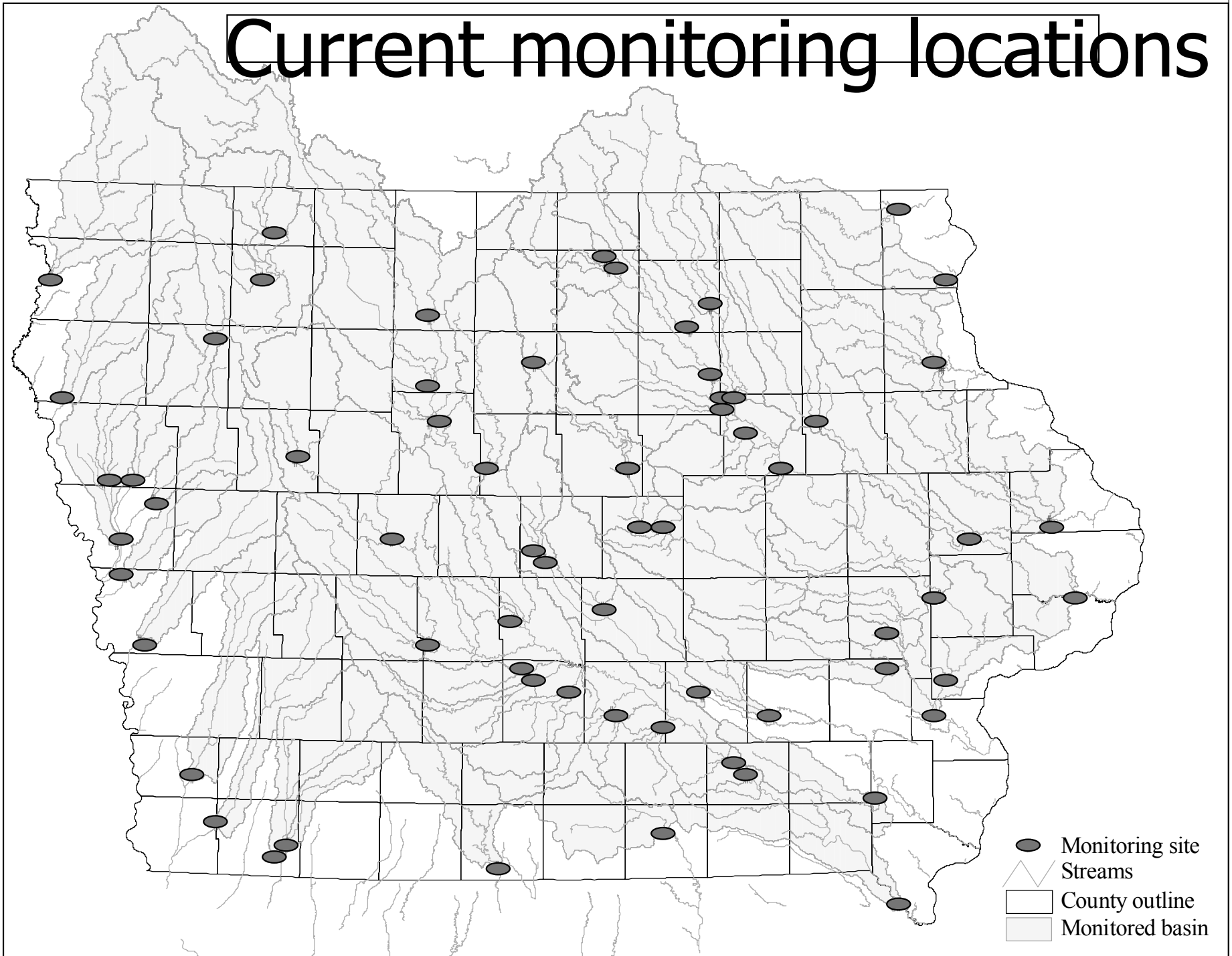
We don’t have a lot of historic monitoring data



Credible scientific sampling of streams

Before ‘99, less than $250,000/yr spent on monitoring

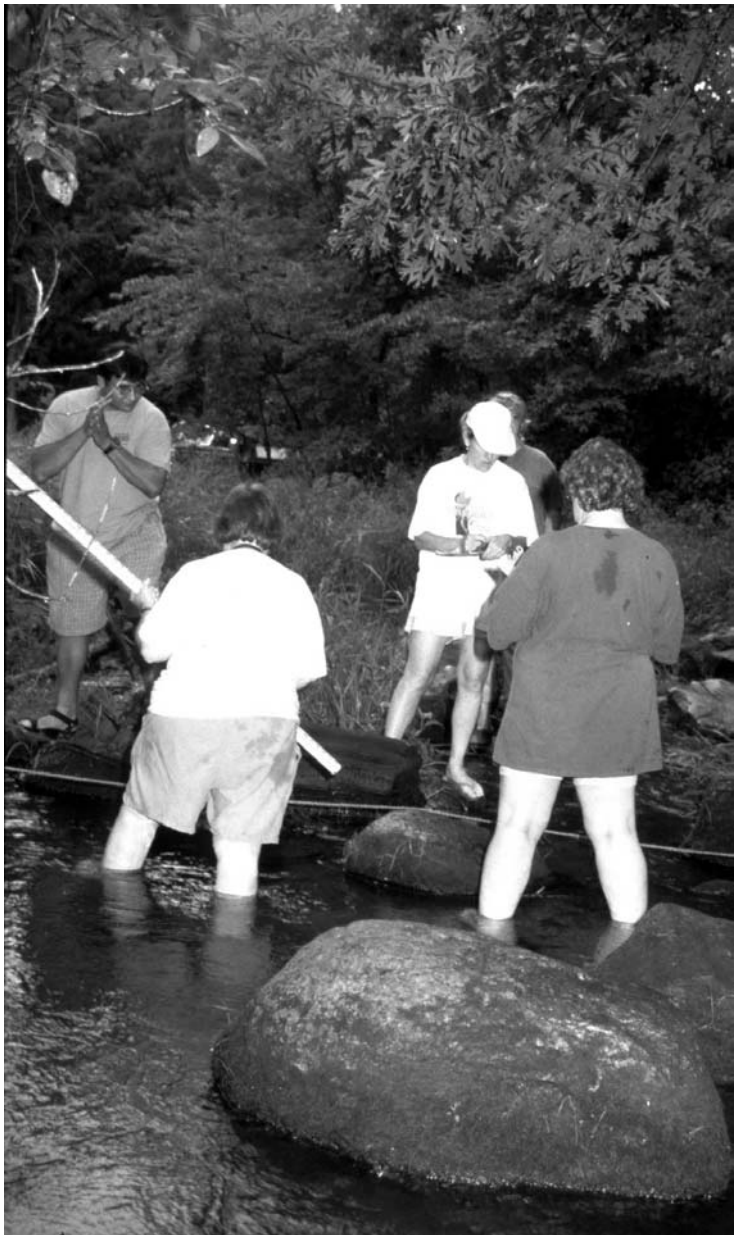
Current monitoring locations



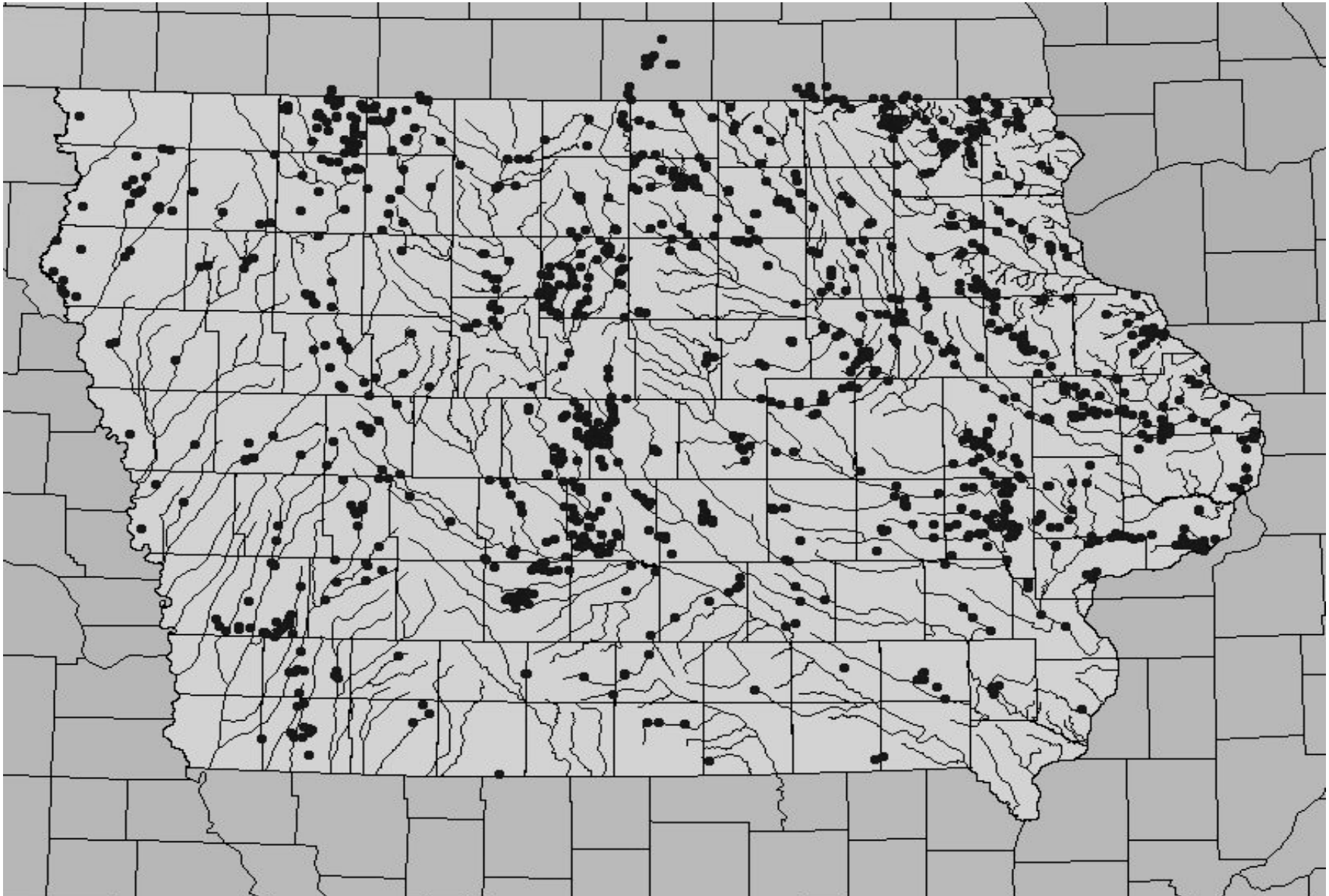
IOWATER Volunteer Monitoring

Education

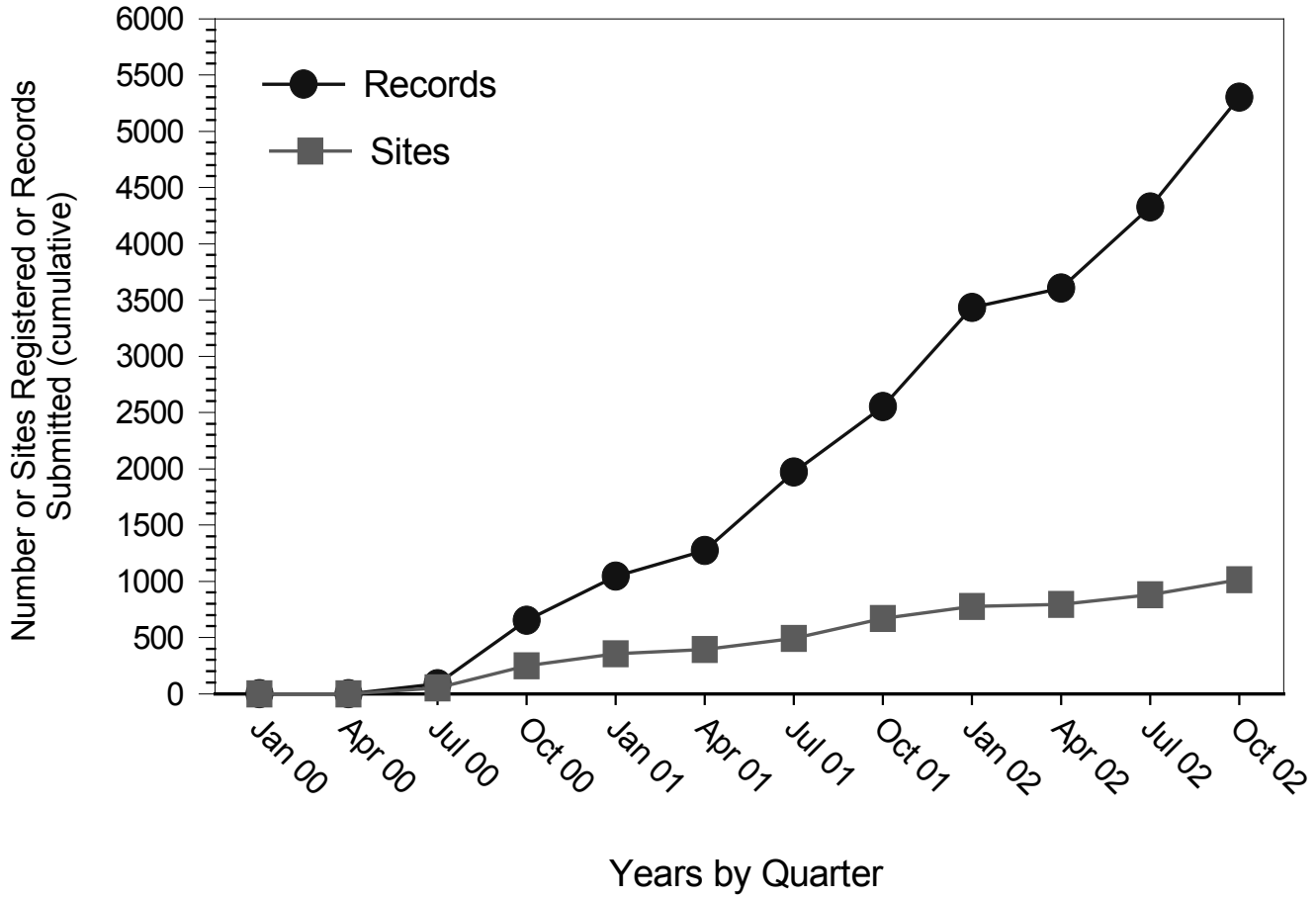
Filling in data gaps



IOWATER Volunteer Monitoring Sites



IOWATER Volunteer Monitoring Sites and Records



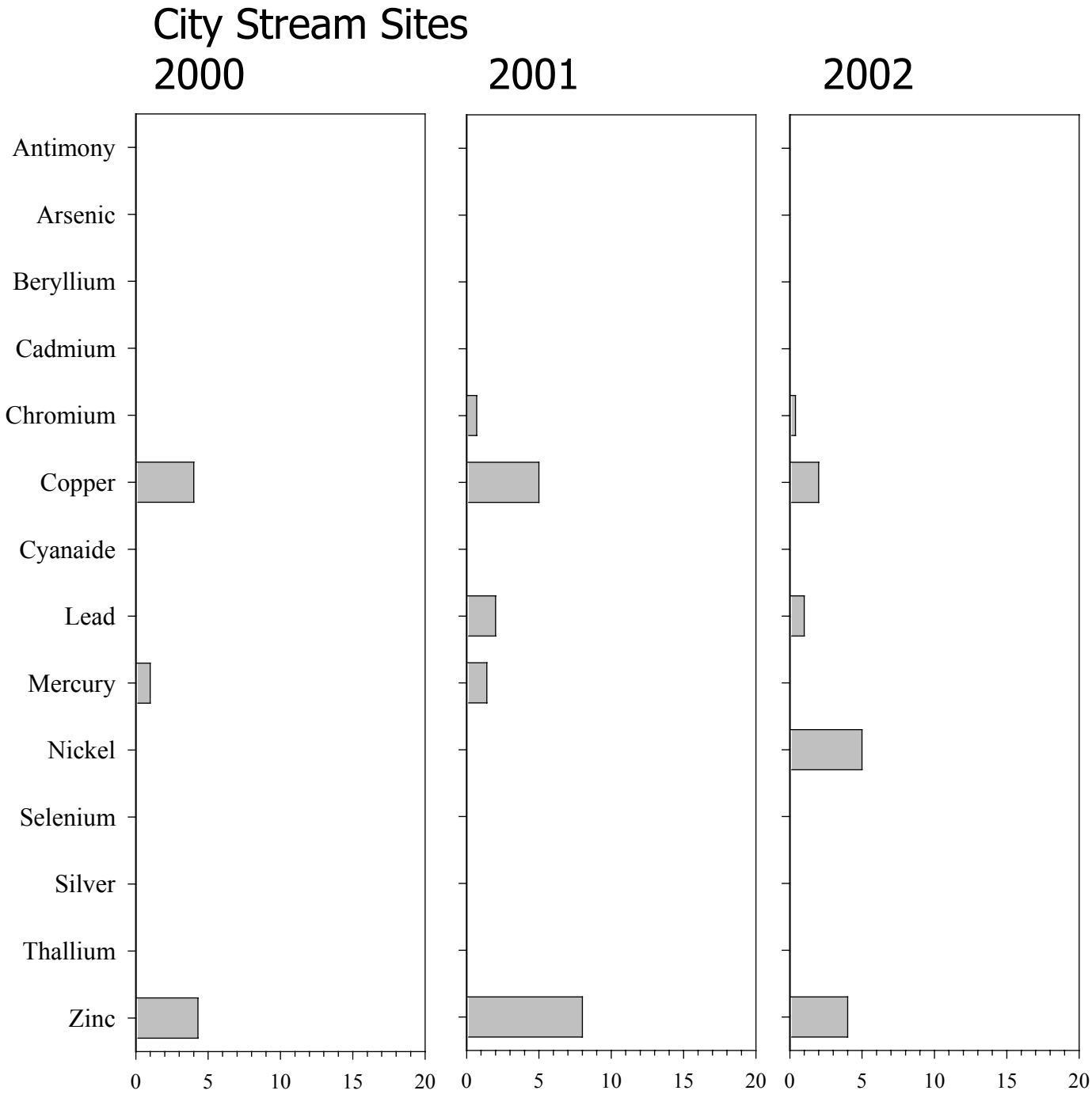
We have limited data, but what do we know about Iowa's water quality?

Some observations and trends

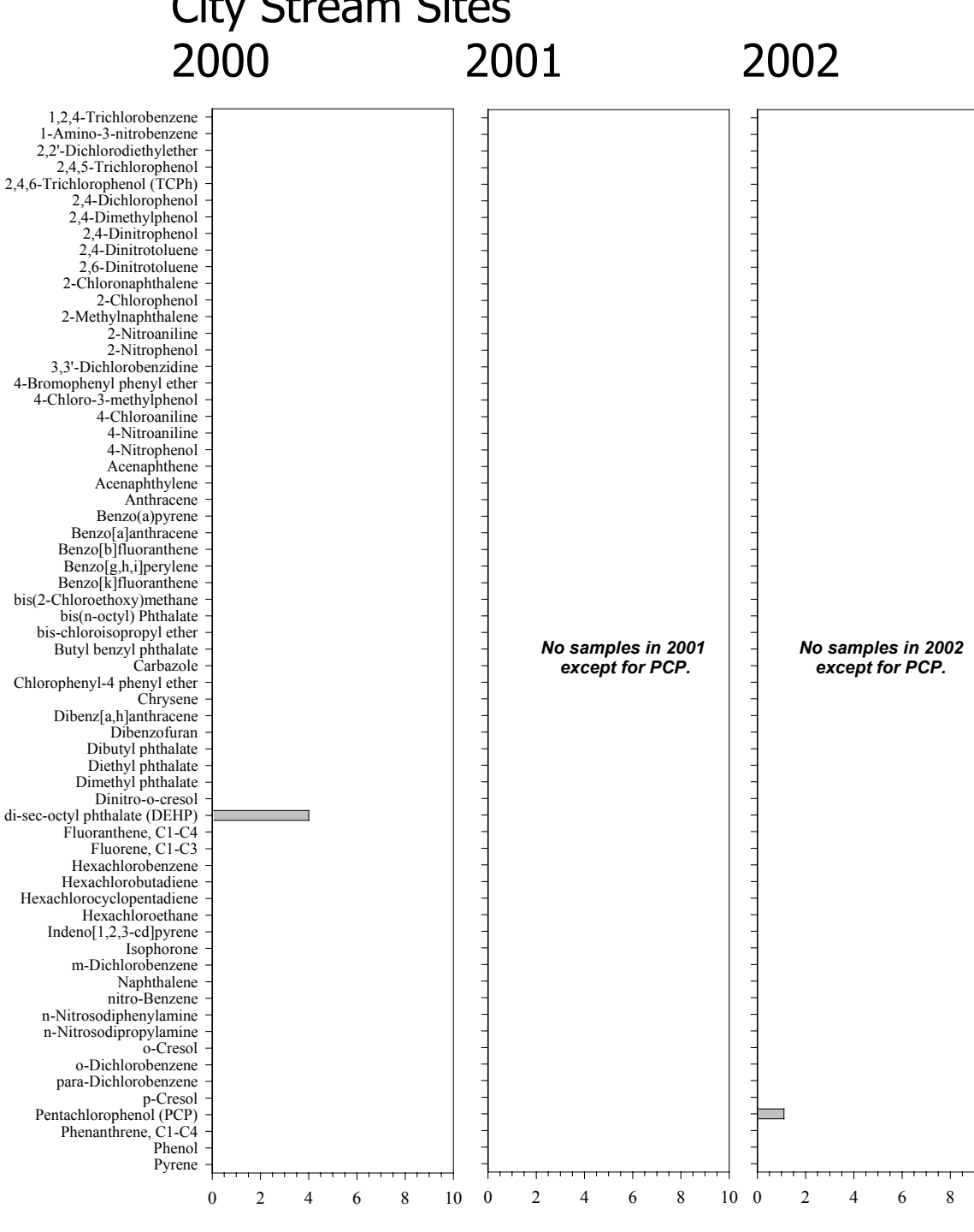
Industrial Pollutants

- Industrial pollutants
  - Metals
  - Synthetic organic compounds
  - Legacy pollutants (PCBs)
- Iowa has not had a large industrial base
- Industrial pollutants seldom detected

Metals


City Stream Sites
2000
2001
2002
Antimony
Arsenic
Beryllium
Cadmium
Chromium
Copper
Cyanaide
Lead
Mercury
Nickel
Selenium
Silver
Thallium
Zinc
0
5
10
15
20

Semi-Volatiles



Municipal/Industrial Wastewater Treatment - A Success Story

Iowa State Department of Health

December 1953

"Odebolt Creek for a distance of at least three miles was found to be grossly polluted. …unfit for normal stream uses. …unsuitable for livestock watering. A hazard exists … to persons coming in contact with the stream water."

February 1962

"Odebolt Creek and its tributary were found to be grossly polluted due to the discharge of milk processing wastes ... and inadequately treated sewage."

Municipal/Industrial Wastewater Treatment - A Success Story

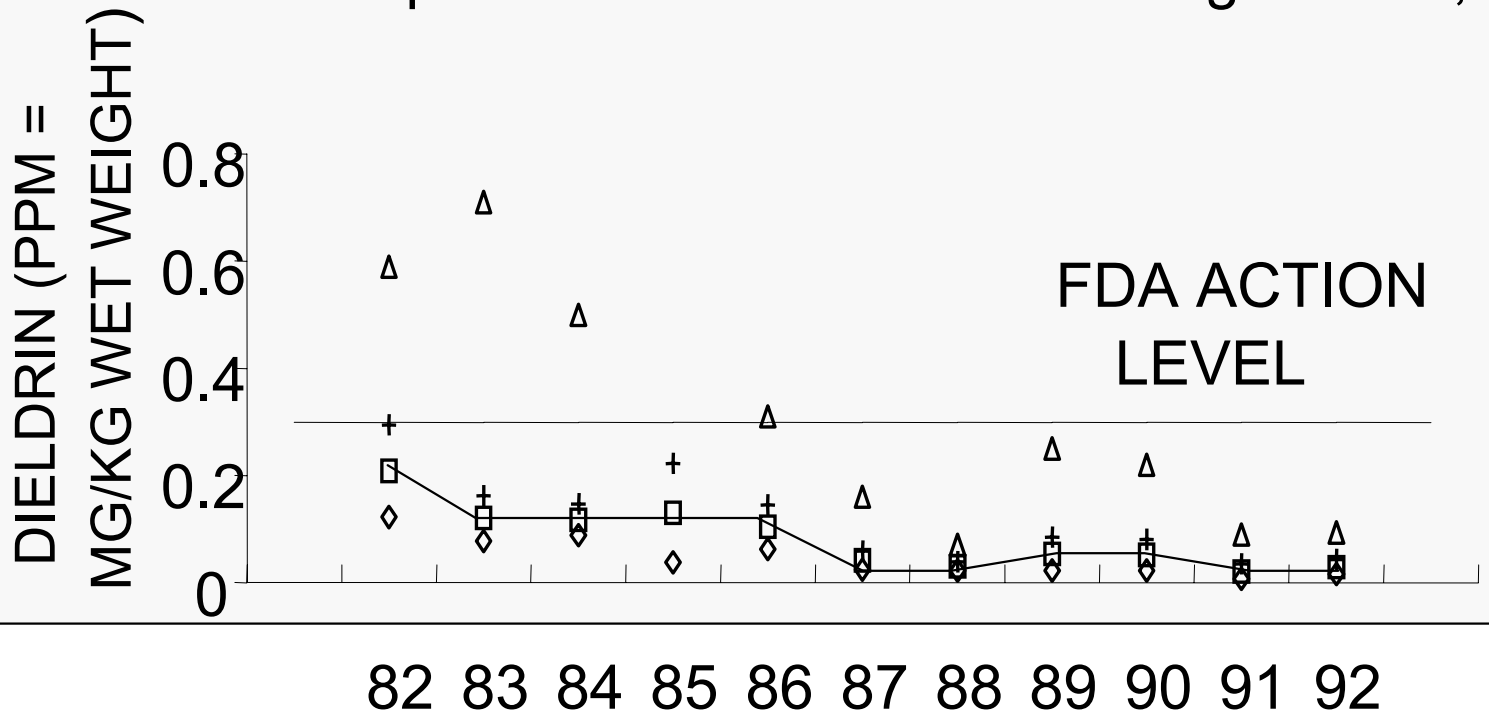
- Some issues still to be addressed
  - Upgrading
  - Meeting new, more stringent requirements
  - Aging infrastructure

Fish Tissue Testing

- 20 years of testing
- Almost all fish safe to eat
- Some pollutants found, but below level of health concern
- Mercury may be increasing – air deposition

Declines in Levels of Toxics in Fish

Yearly means of dieldrin (+/- two times standard error) in fillet & whole fish samples from U.S. EPA monitoring in Iowa, 1982-1992



Habitat is often as important or more important to “aquatic health” of waterbodies as chemical water quality

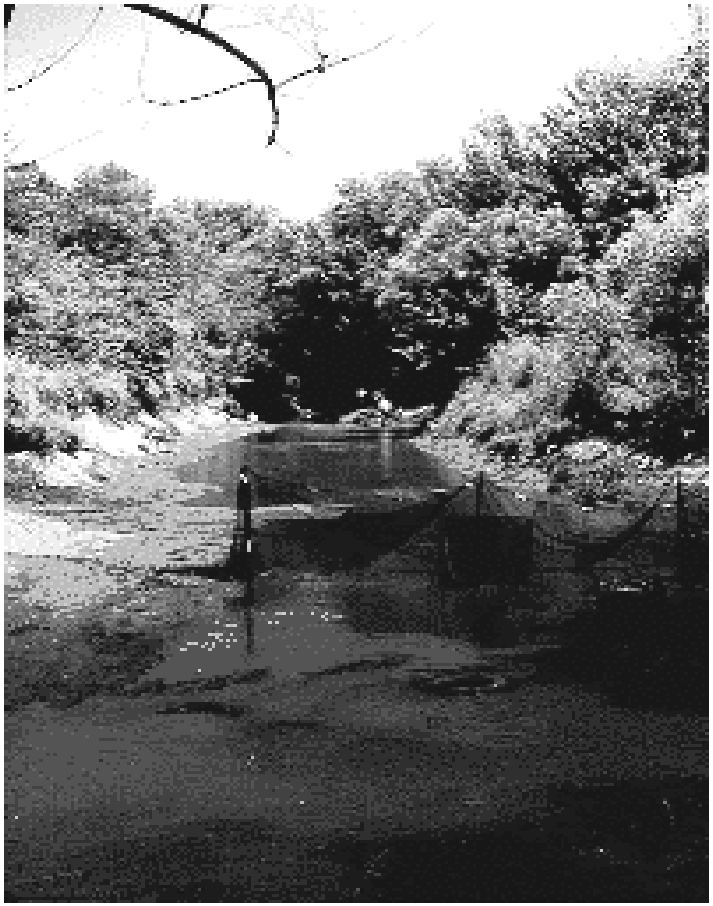
Habitat Modification

Channelization vs. Meandering

Stream Channelization

Chariton River/Channel Catfish

149 fish, 45 pounds



21 fish, 1 pound

Habitat – Bigalk Creek

Habitat destruction

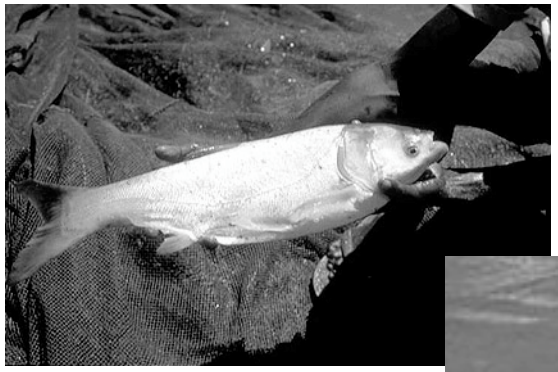
Habitat – Bigalk Creek

Habitat restoration

Less than $500

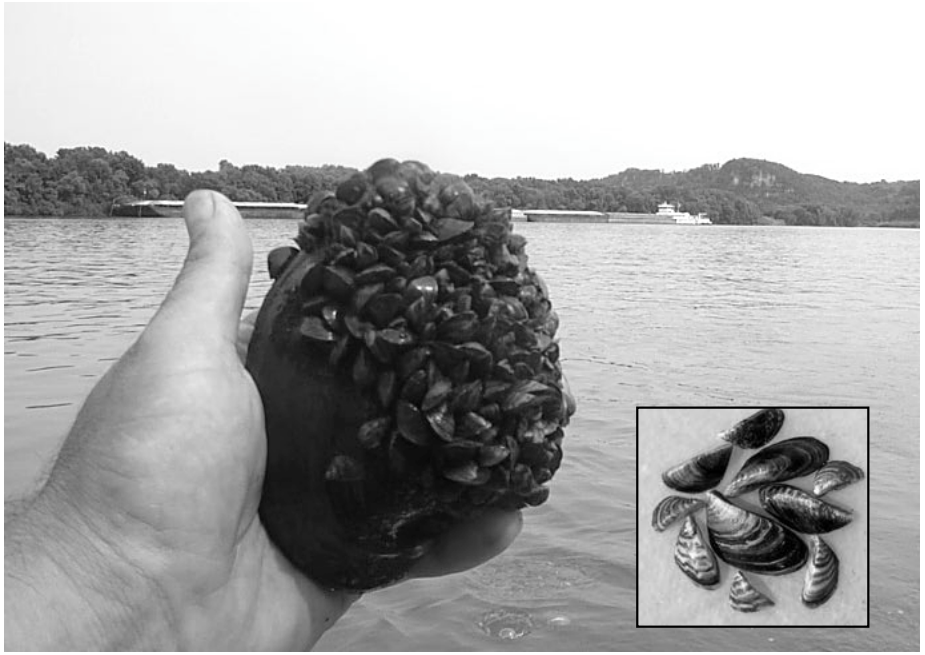
Invasive and exotic species have taken a toll, new ones appearing

Carp



Silver Carp

Purple Loosestrife

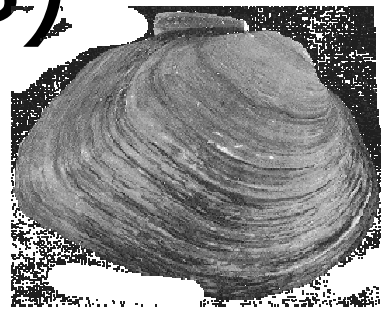


Zebra Mussel


Ventura Marsh After Fish Removal

Mussels (freshwater clams)

The Canaries of Our Waters?



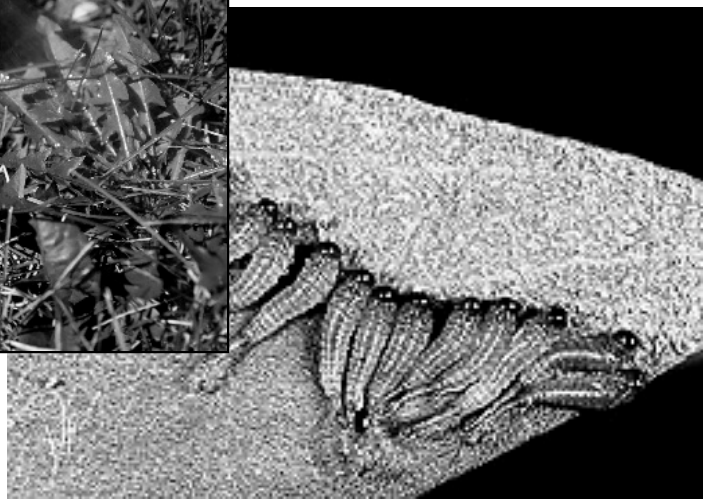
- Iowa once had very rich population - number and types
- Precipitous decline
- Long-lived
- Complex life cycle
- Cause of decline uncertain

Mussels - ‘84 versus ‘98

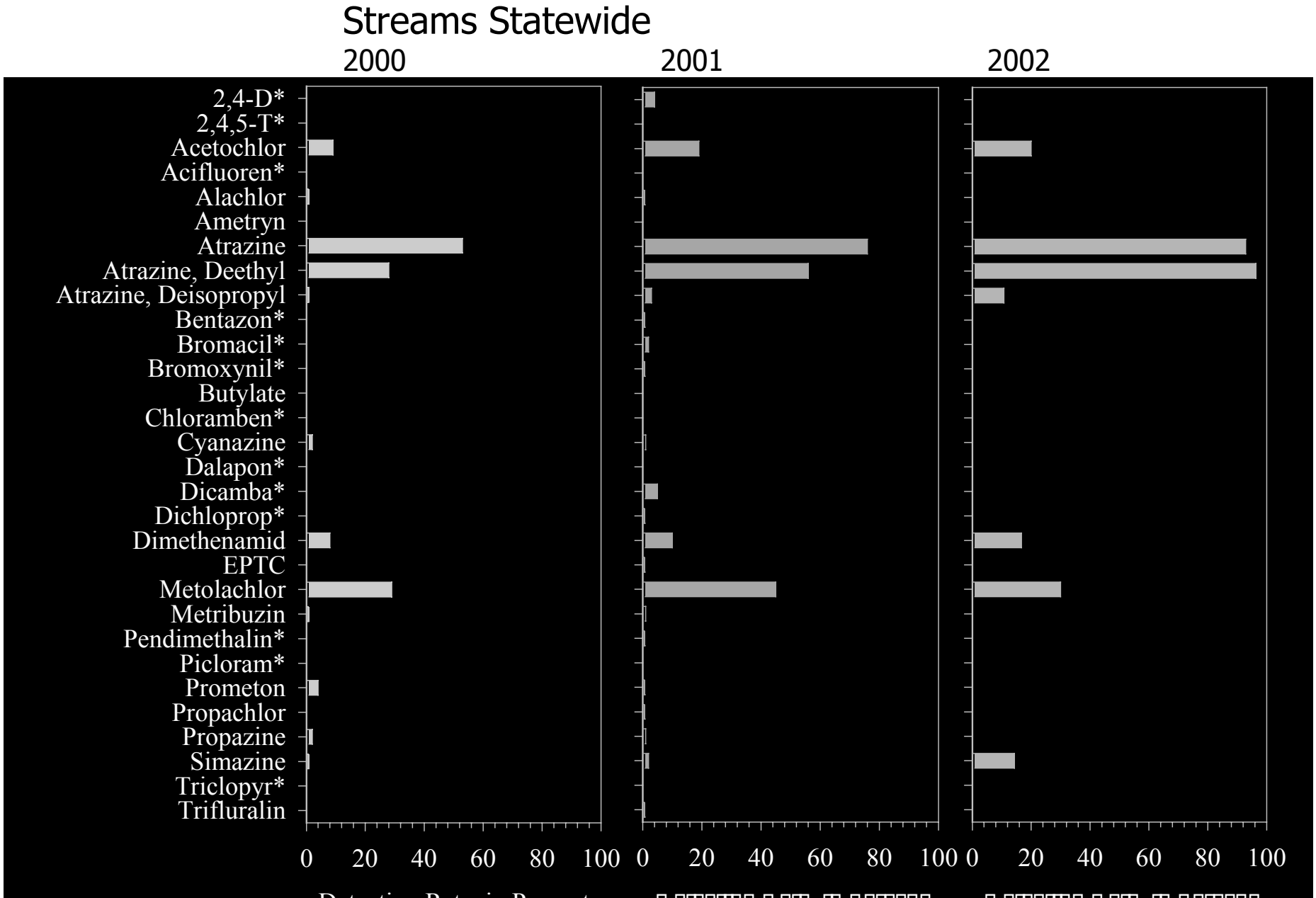
	Frest ’84 – ‘85	Arbuckle & Downing 1998
Number of sites	171	118
Ave. species richness/site	5.4	1.9
Maximum species richness/site	22	12
% Species absent	6%	47%
Comparative richness	---	22% = or greater; 58% lost >75% of richness

Pesticides

- Many pesticides or their breakdown products detected in water
- Amounts typically below known levels of concern

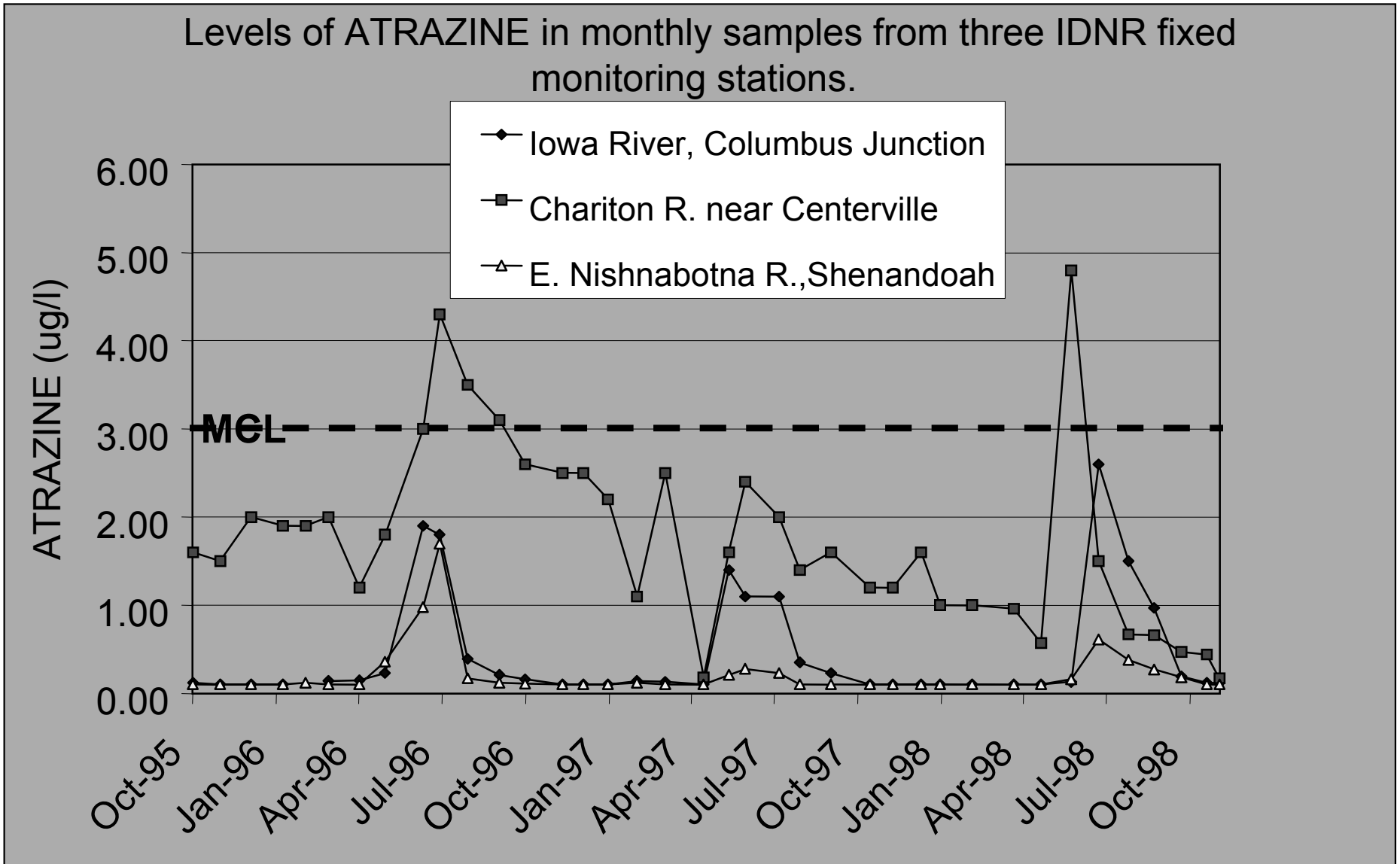


Detection Frequency of Herbicides



Pesticides

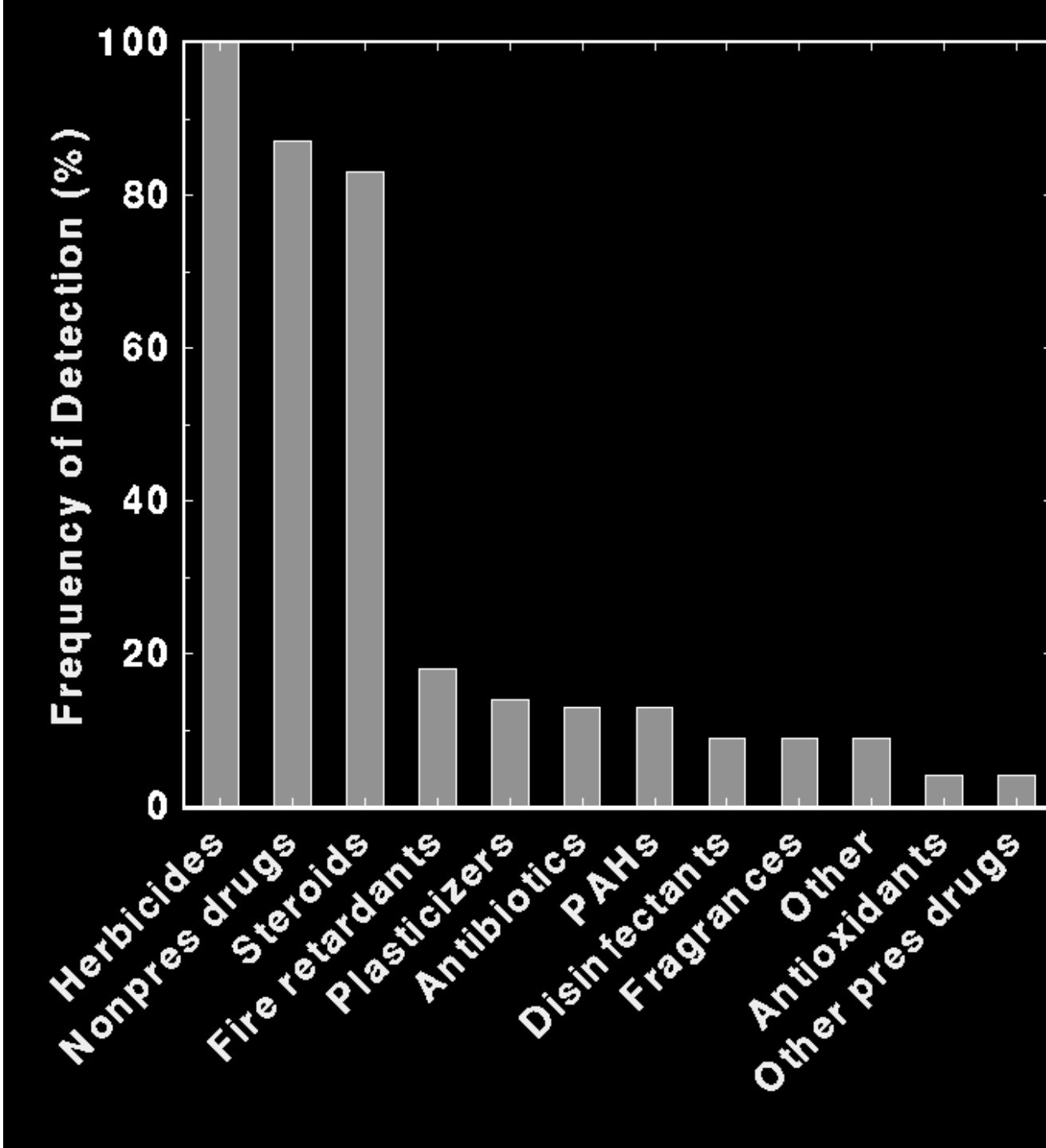
Sometimes exceed drinking water standards



Antibiotics and Other Compounds

- Minute amounts often found
  - Antibiotics - humans, animals
  - Synthetic compounds
    - Manufacturing chemicals
    - Birth control products, etc.
- Antibiotic resistant bacteria
- Some synthetics may affect human and animal endocrine systems
- More research needed

Detection by Chemical Category



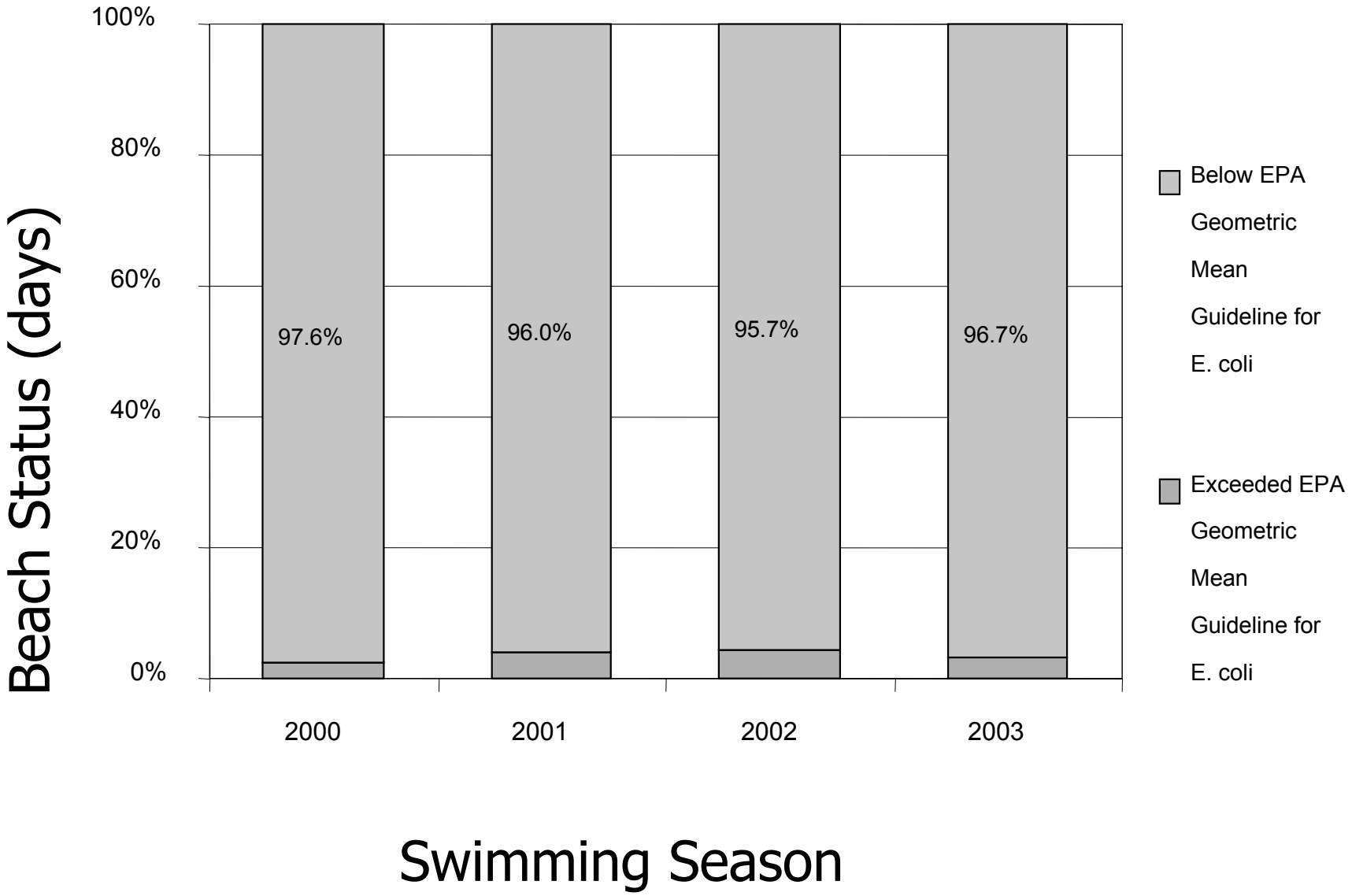
Most waters contain some amount of fecal material

- Municipal wastewater
- Inadequate "septics"
- Wildlife
- Animals and manure

Beaches

- State beaches monitored for bacteria
- Most safe for swimming
- State park beaches exceed standards less than 4% of the time

Status of State Beaches



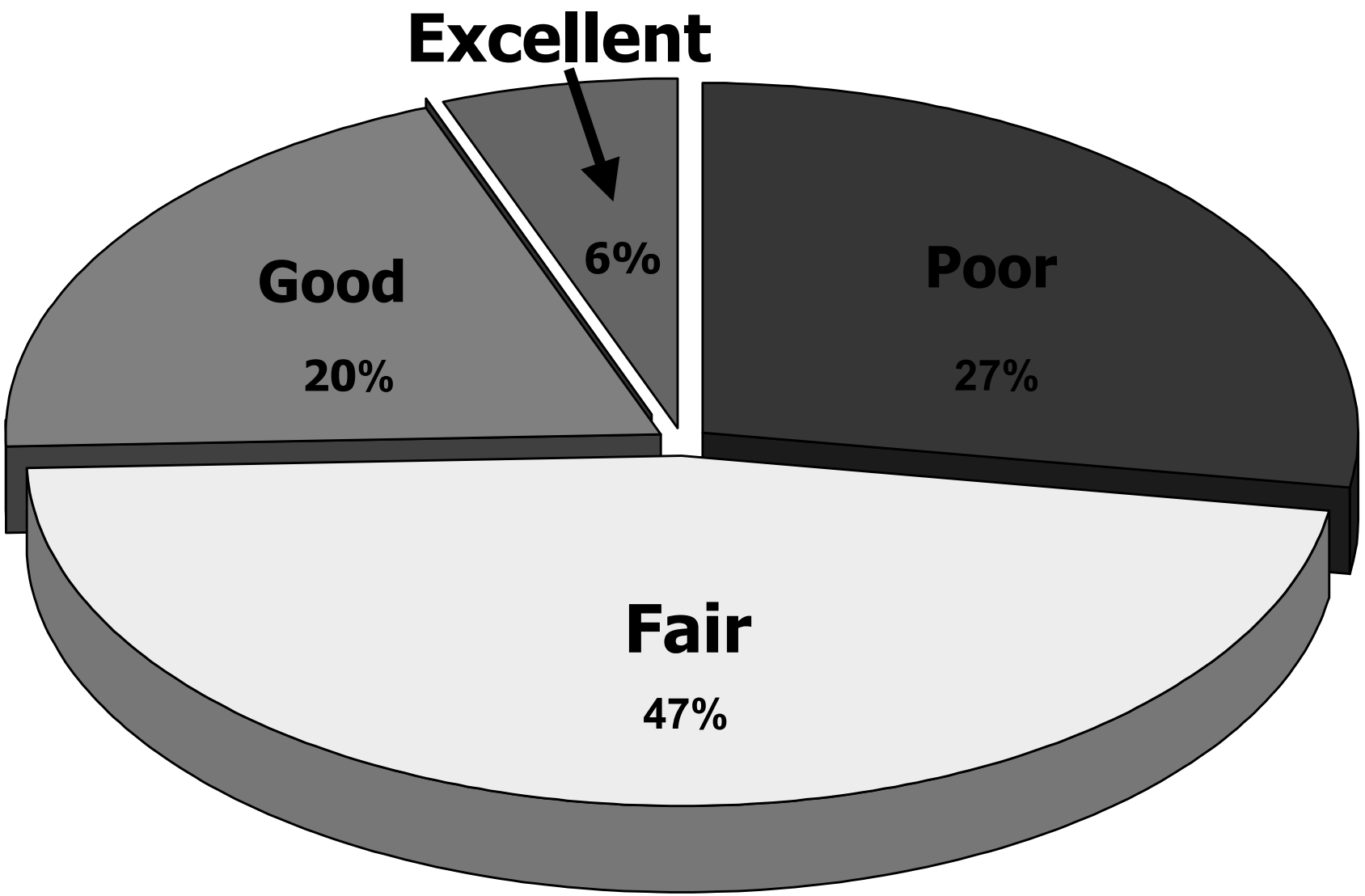
Iowa's aquatic populations

- Biological surveys used to measure aquatic health
- Fish and aquatic "bugs"
- Overall aquatic health of our waters is OK, but not great

2002 Random Sampling Project

51 Stream/River Sites

Fish Index of Biological Integrity

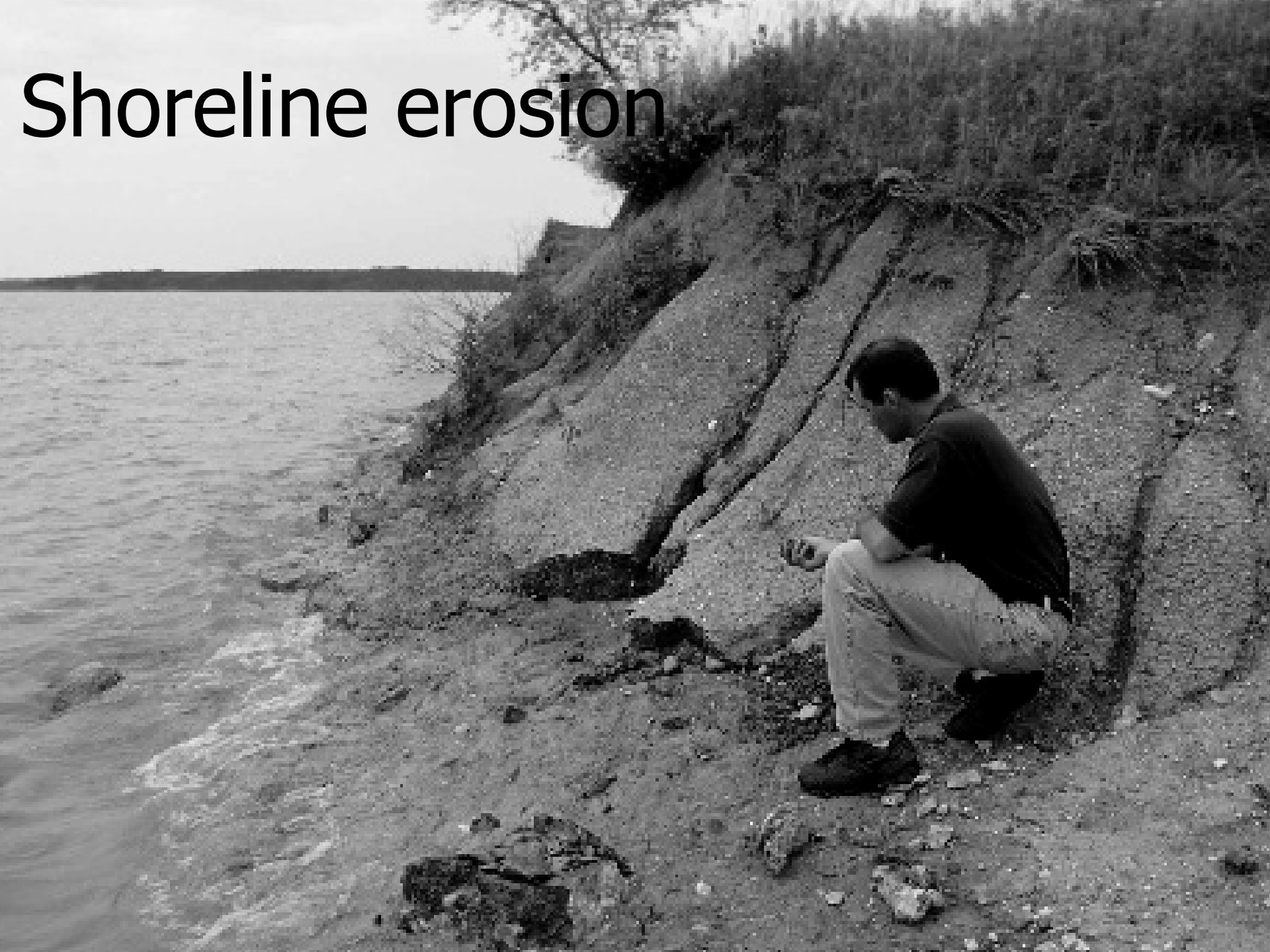


Soil erosion is still a major water quality problem

- Urban and agricultural
- Upland sheet and rill
- Gully erosion

Stream bank erosion

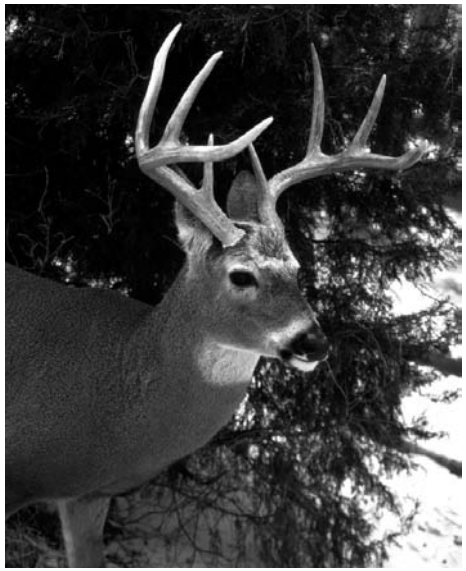
Shoreline erosion




Soil erosion = muddy waters

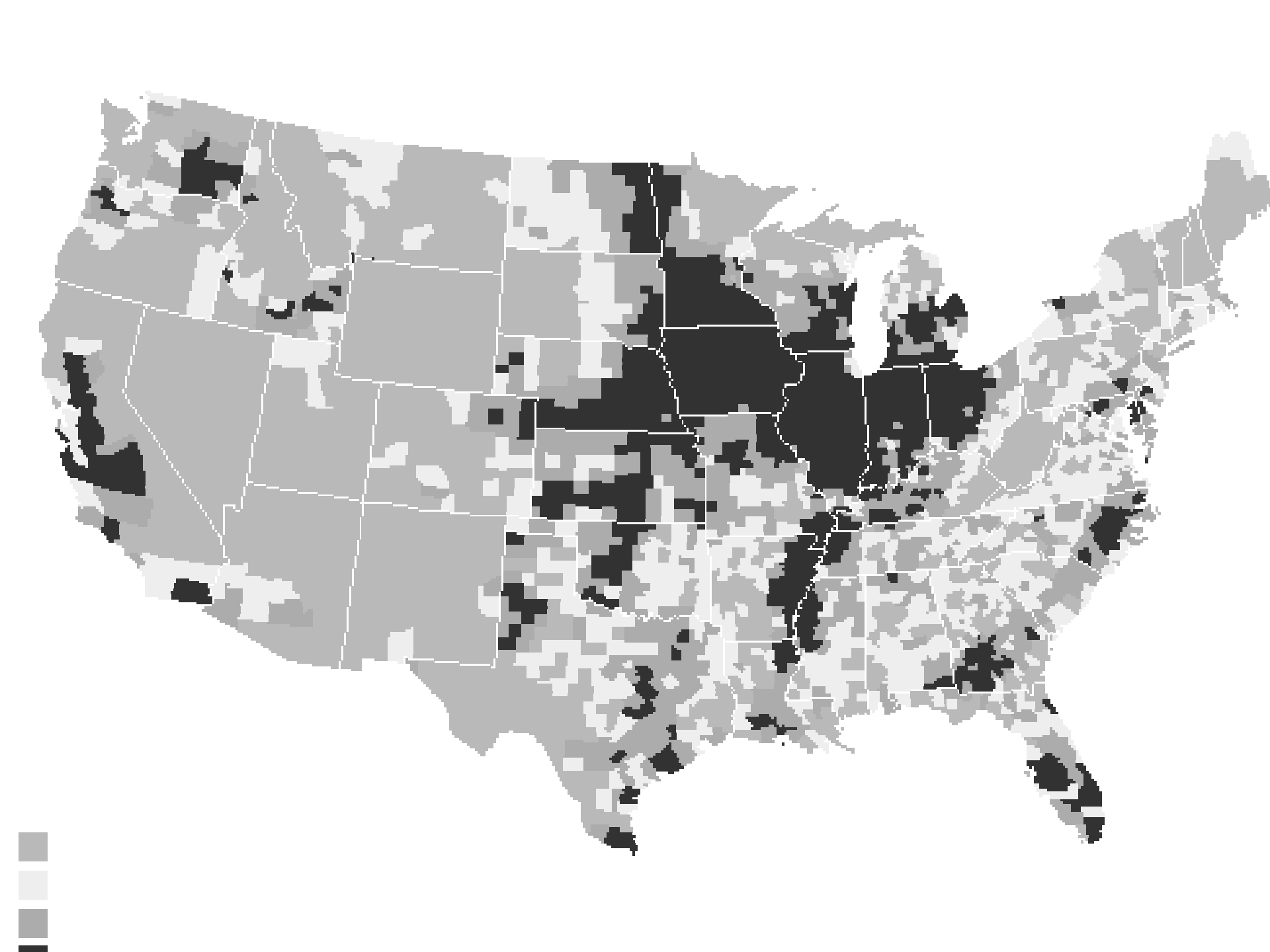
Our rivers and lakes have very high levels of nutrients

- Nitrogen and phosphorus
- Essential for life, but too much of a good thing



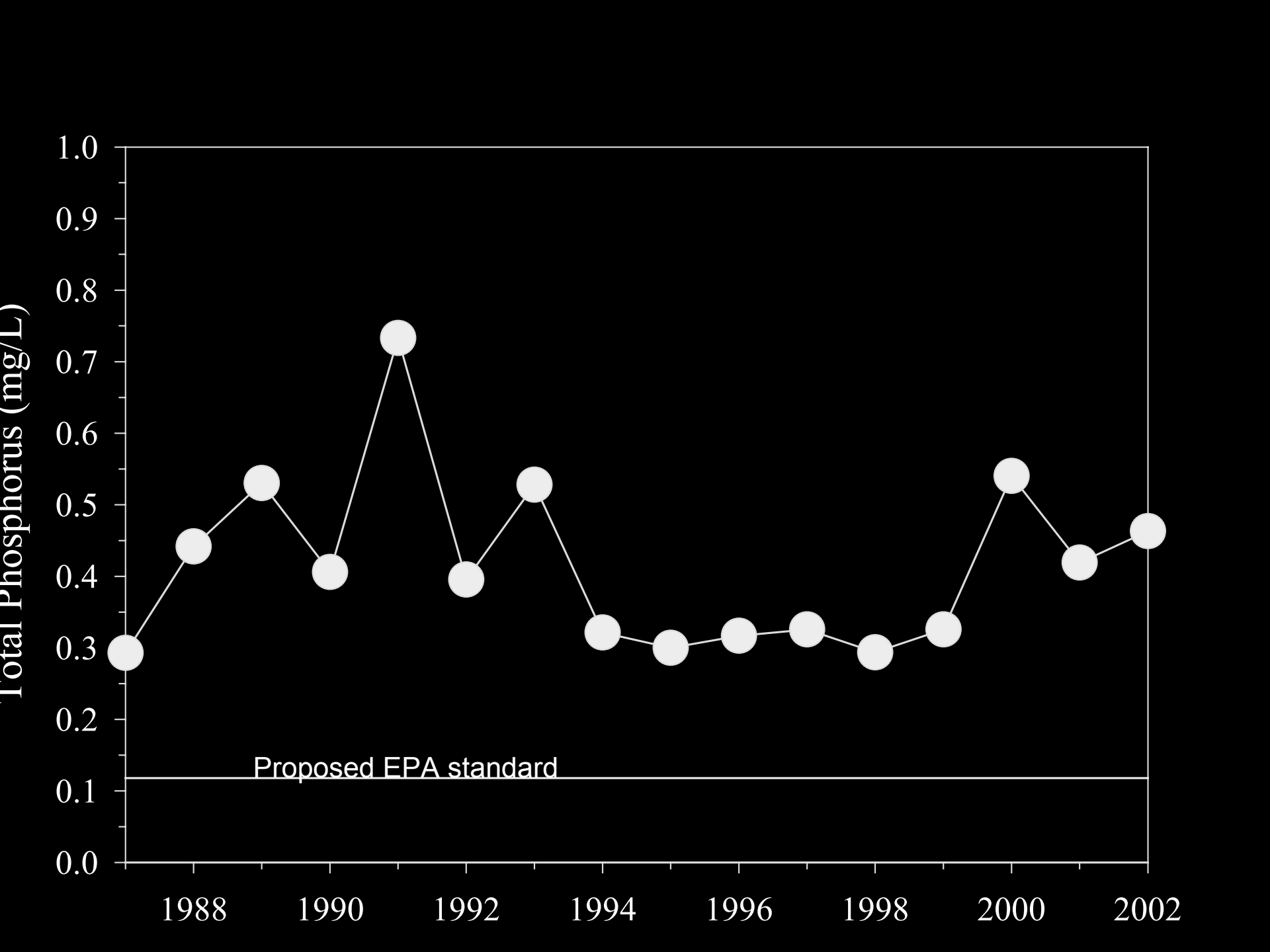
Nutrients -Why the concern?

- 2000 National WQ Inventory: nutrient over-enrichment impairs
  - More than 20% of rivers
  - 50% of lakes
  - Agriculture reported as largest source of nutrient impairment
- Hypoxic zone in the Gulf and mid-Atlantic coast Pfisteria outbreaks - linked to nutrient over-enrichment



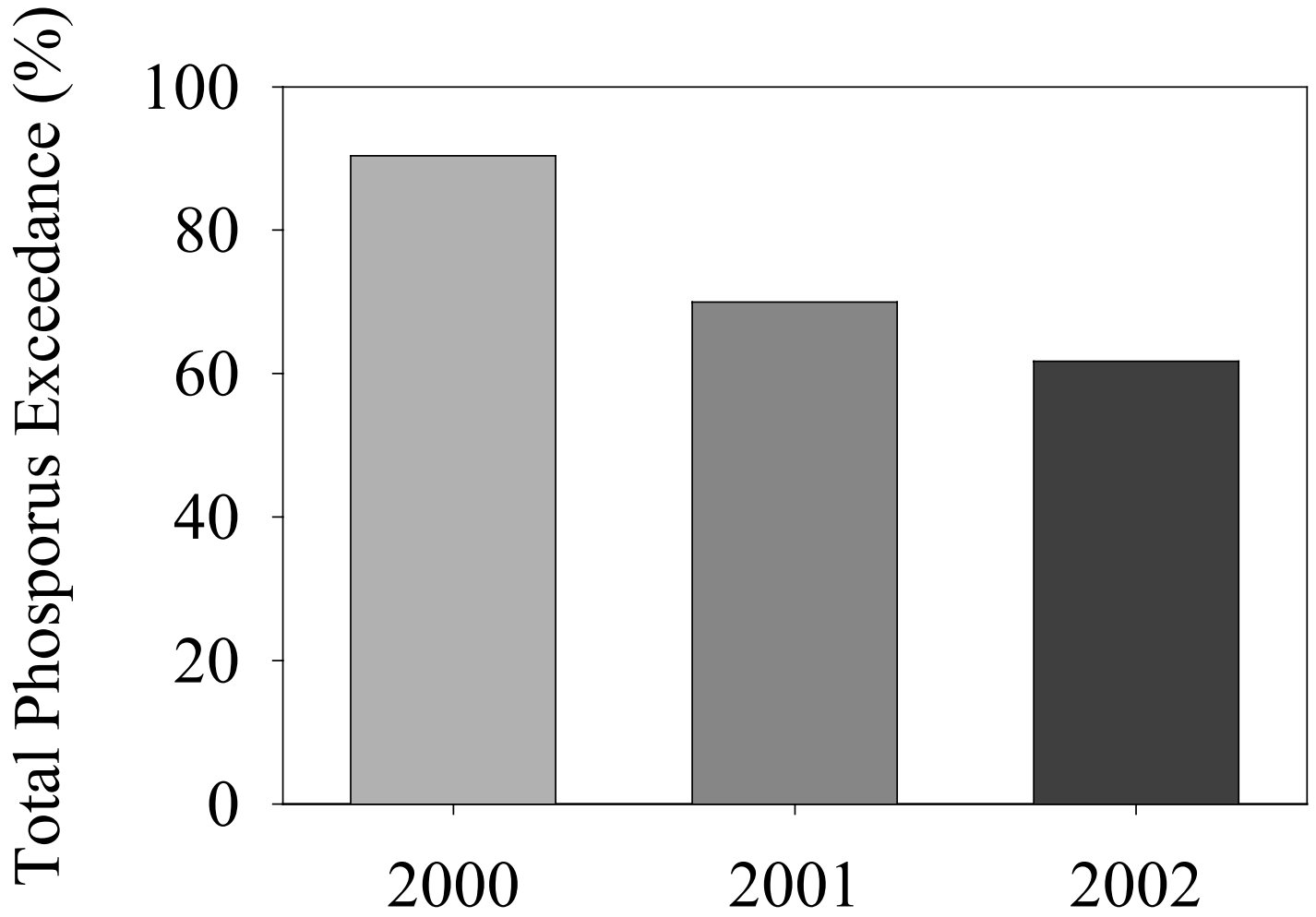
Nutrients -Why the concern?

- Algae and aquatic vegetation
  - Nuisance
  - toxic algae
- Low oxygen levels
- Increased turbidity
- High nitrate levels in drinking water
- Disinfection by-products in drinking water that can cause cancer
- Imbalance of aquatic species


Total Phosphorus (mg/L)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Proposed EPA standard
1988
1990
1992
1994
1996
1998
2000
2002

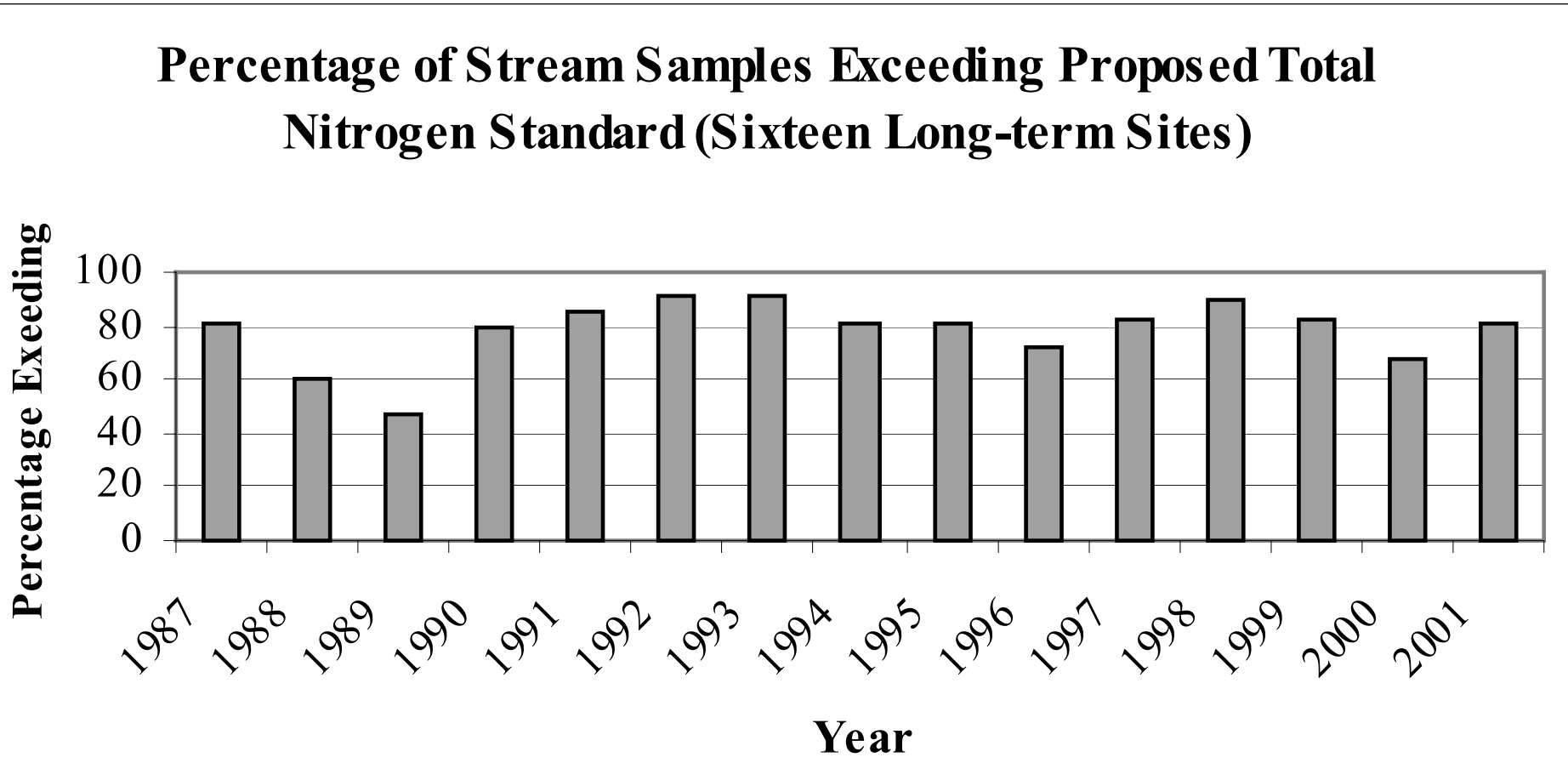
Ambient Monitoring Lake Data

2000 - 2002

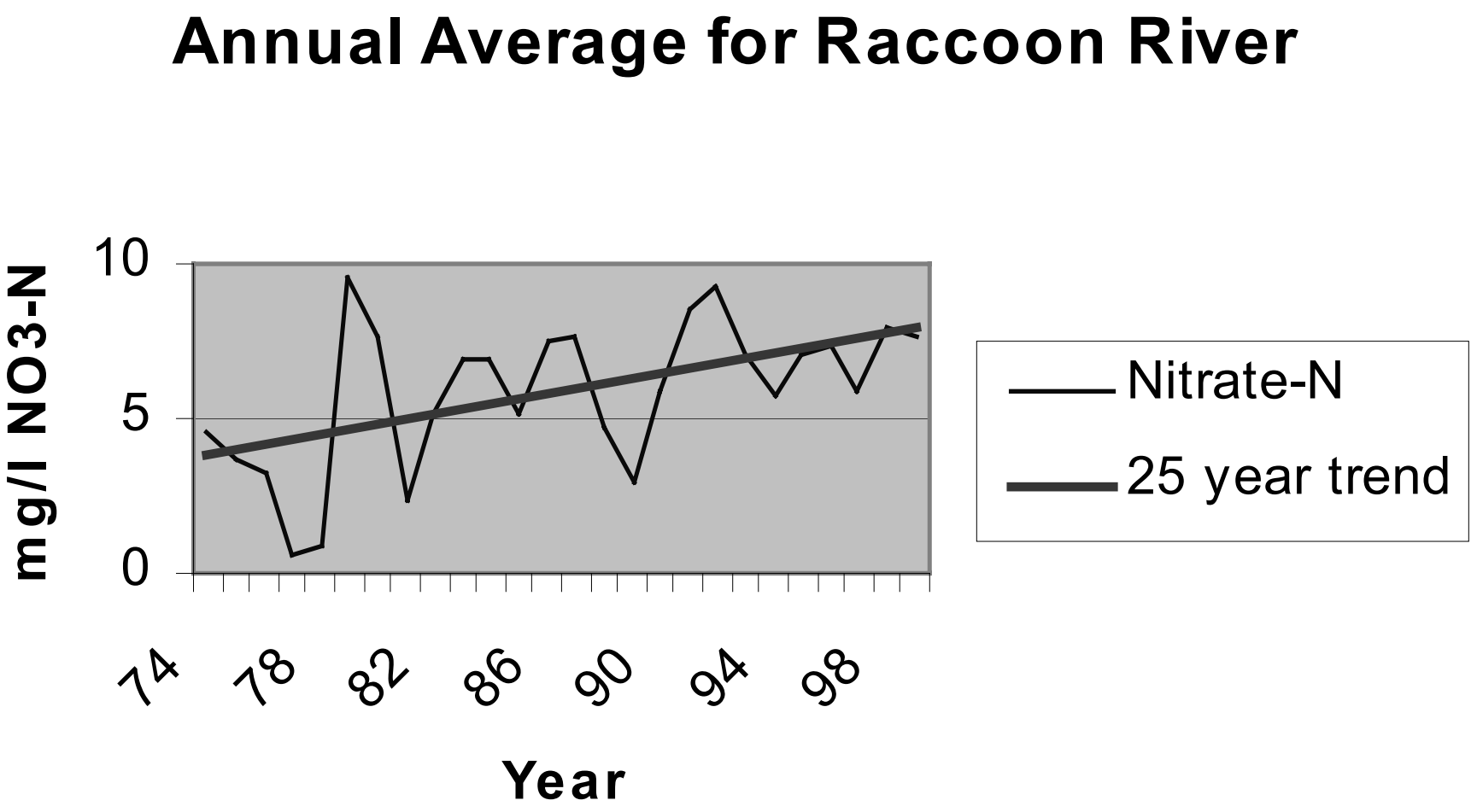


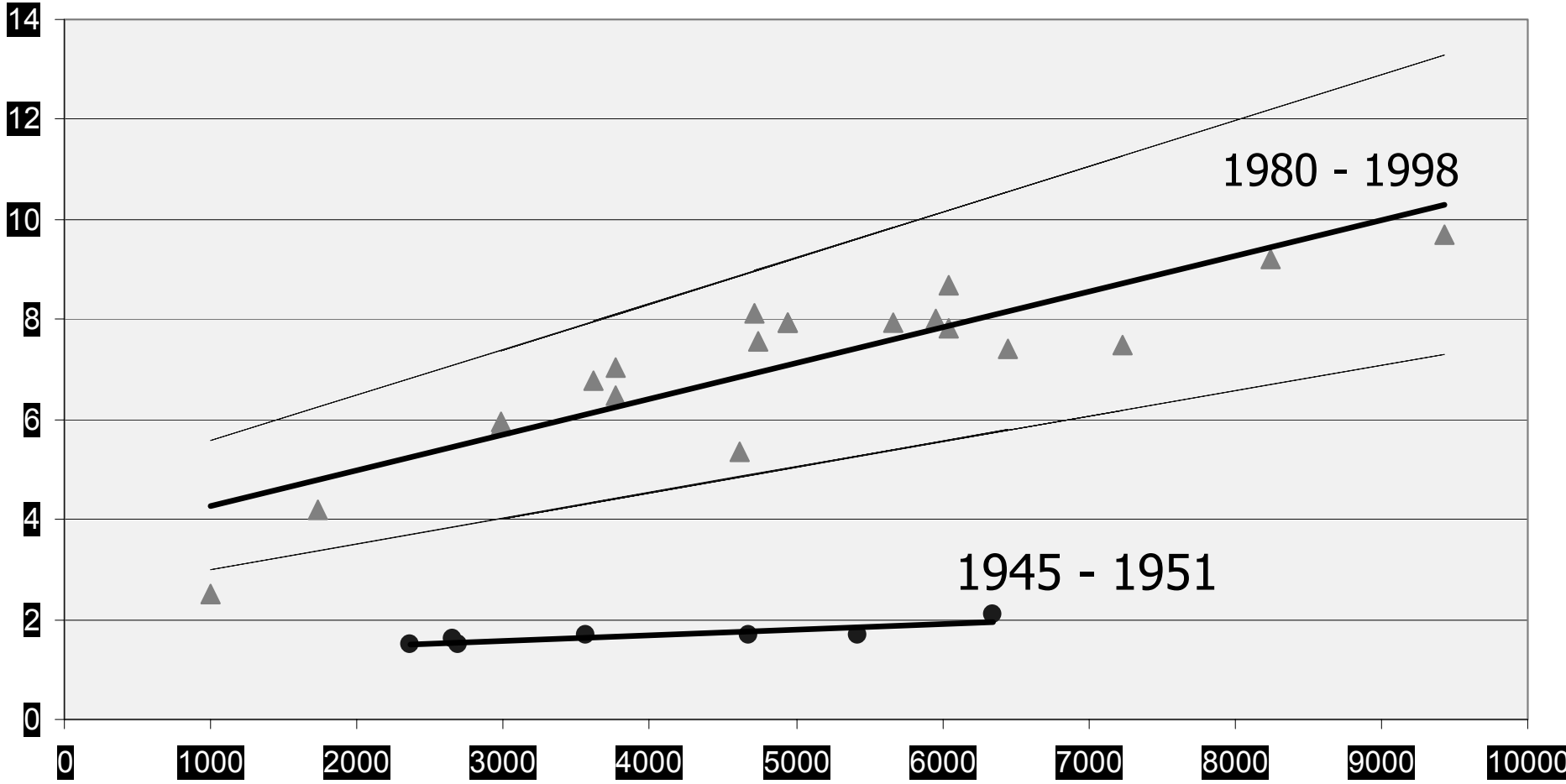
Total P - 0.055 mg/L

Total Nitrogen in Streams



DM Water Works NO_3 Data




14
12
10
8
6
4
2
0
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
1980 - 1998
1945 - 1951

Statewide Groundwater Contamination (SWRL, 1988-1989)

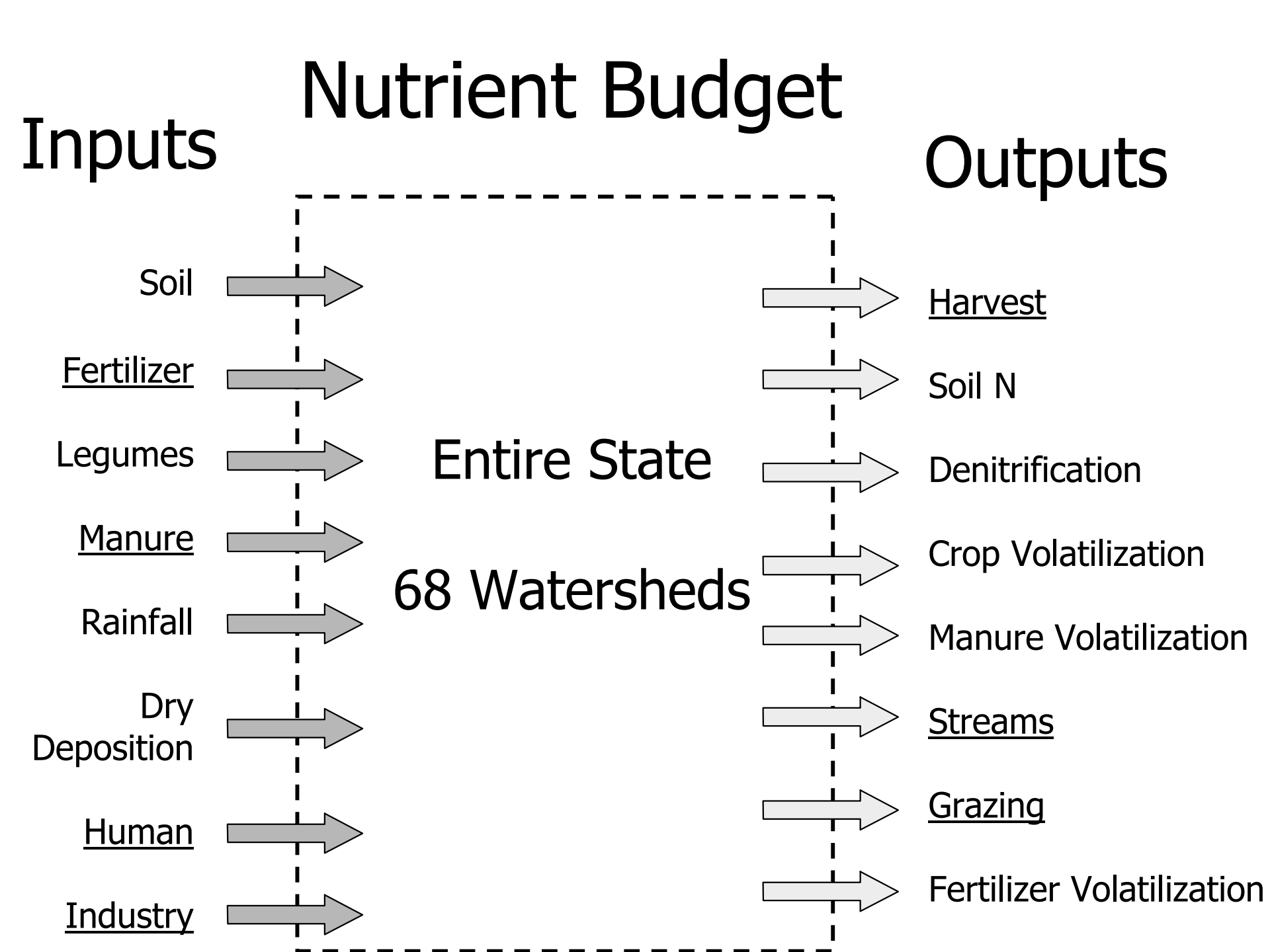
Private Drinking Water Wells	Nitrate – N Above 10 mg/l	Pesticide Detections
< 50 Feet Deep	35.1%	17.9%
> 50 Feet Deep	12.8%	11.7%
All Wells	18.3%	13.6%

Comprehensive Nutrient Strategy

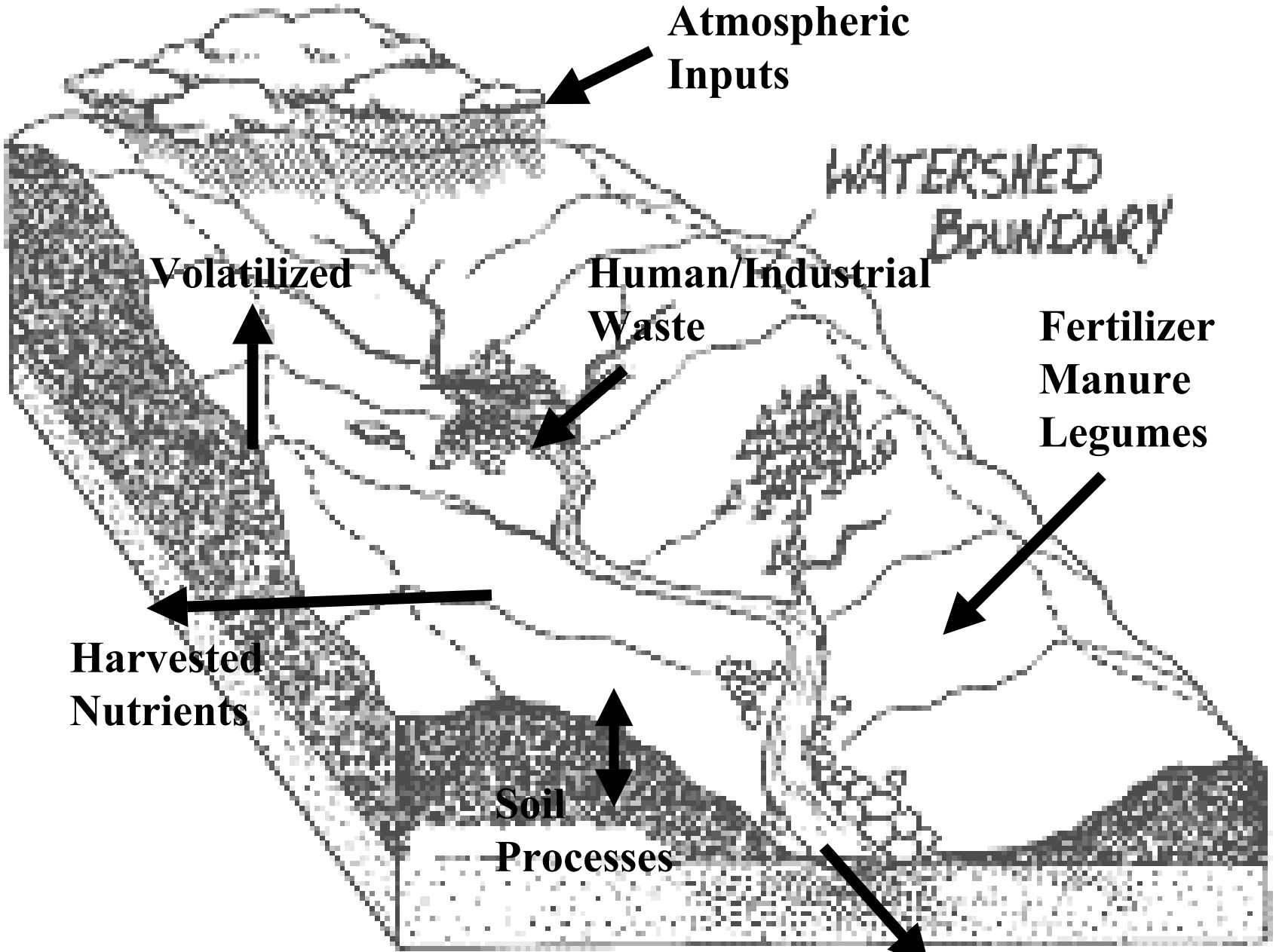
- Where does the nitrogen and phosphorus in our waters come from?
- What can Iowa do to reduce the levels in water?

Iowa Nutrient Strategy

- Develop nutrient budget
- Assess technologies to reduce nutrients
- Assess impacts on water & environment
- Assess economic impacts
- Develop water quality standards
- Identify alternatives/develop consensus


Nutrient Budget
Inputs
Outputs
Soil
Fertilizer
Legumes
Manure
Rainfall
Dry Deposition
Human
Industry
Entire State
68 Watersheds
Harvest
Soil N
Denitrification
Crop Volatilization
Manure Volatilization
Streams
Grazing
Fertilizer Volatilization

What is a Nutrient Budget?

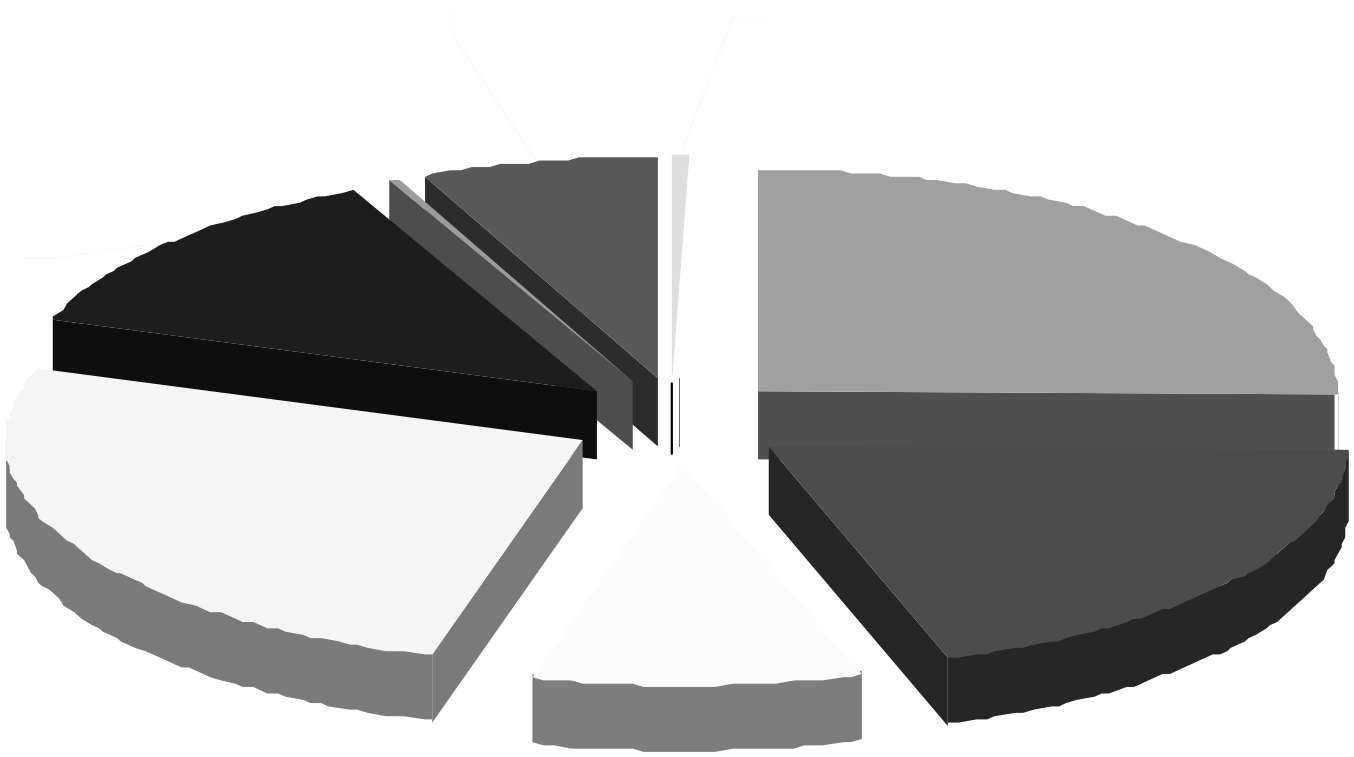


Nutrient Budget

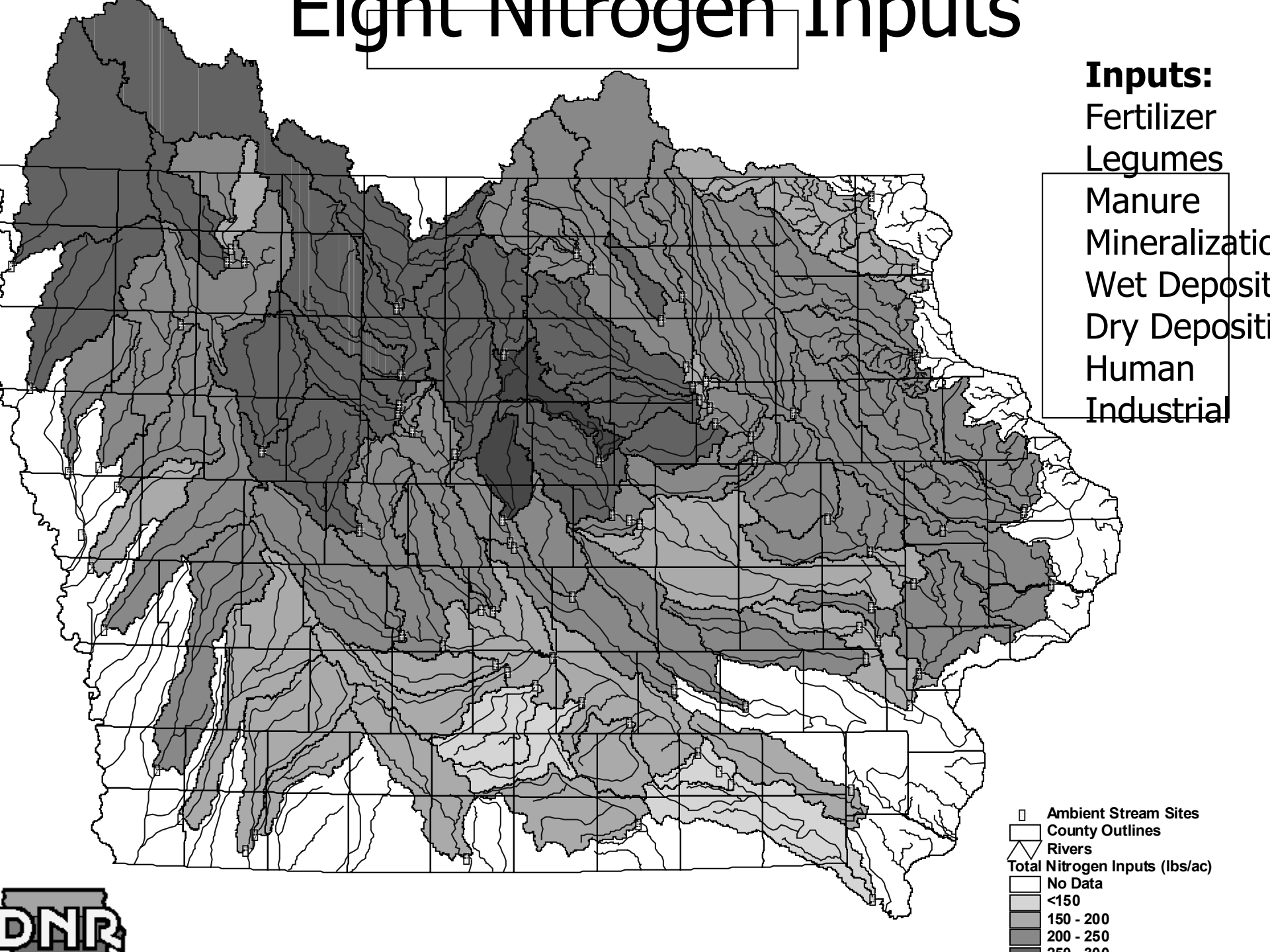
- First for Iowa
- Estimates based upon most acceptable data sets and 'average' values
- Data allocated using GIS procedures

- There is some uncertainty associated with these estimates

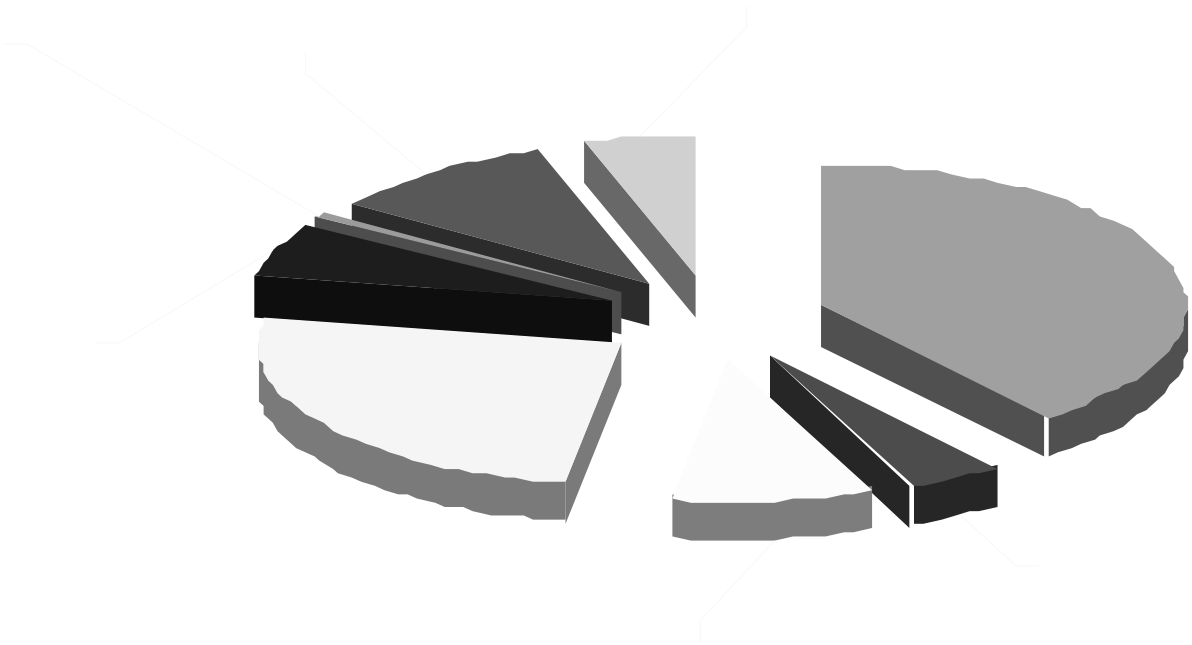
Nutrient Budget – Nitrogen Inputs



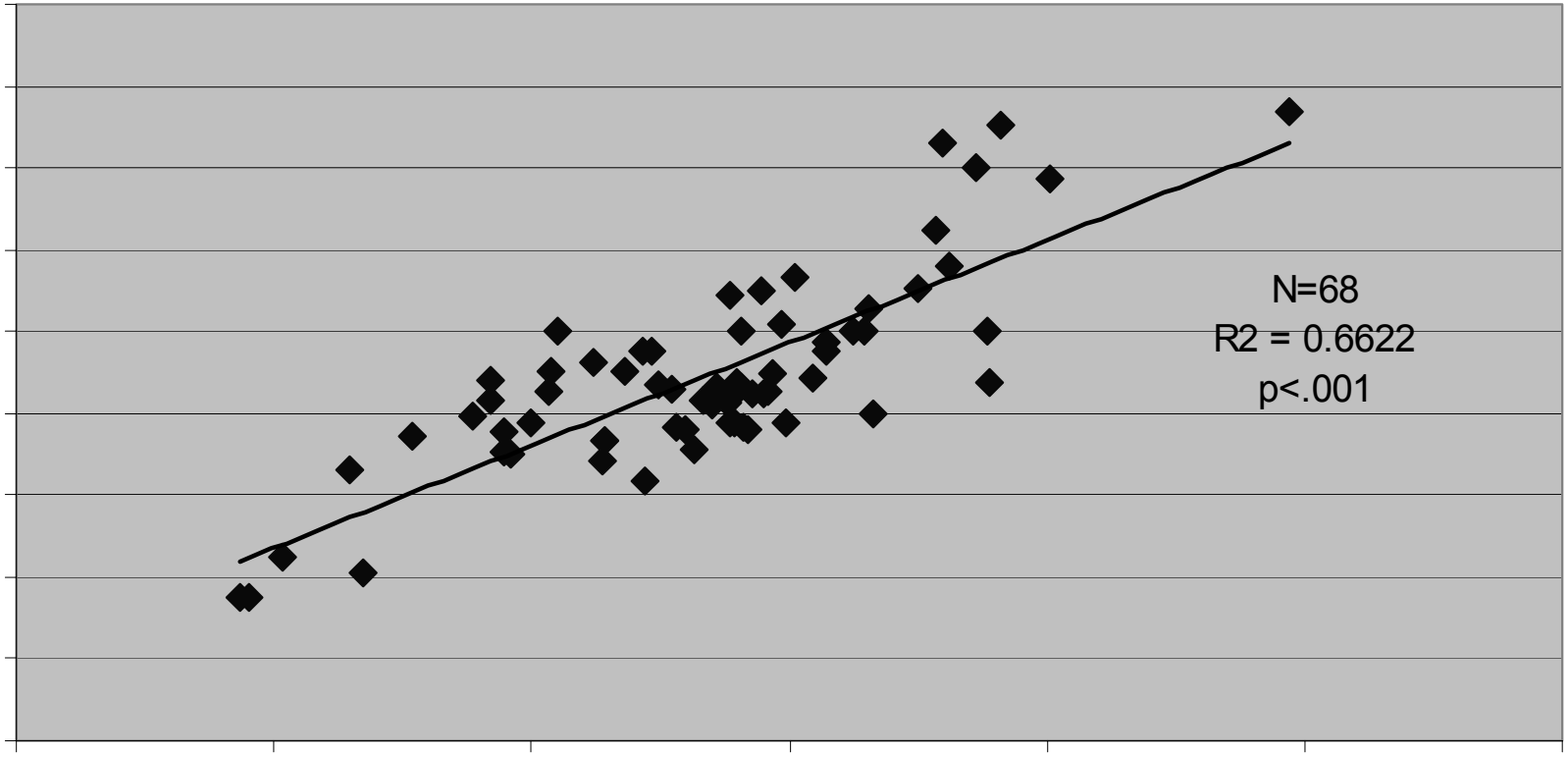
Eight Nitrogen Inputs



Nutrient Budget – Nitrogen Outputs



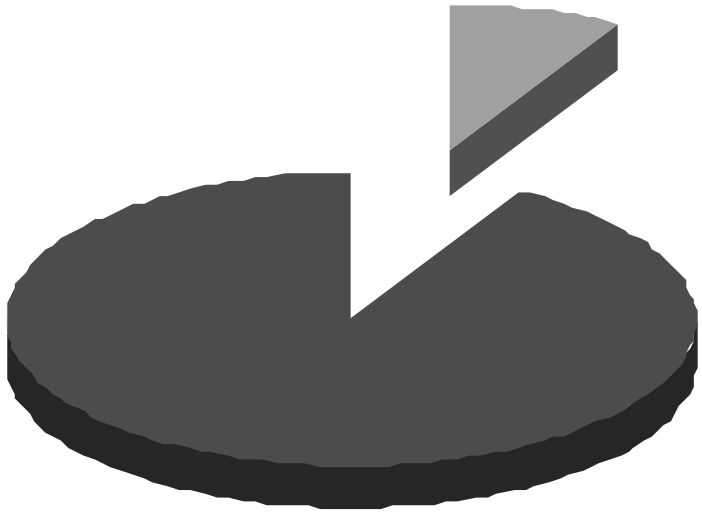
Total N Inputs per Basin vs. Total N Stream Concentration



Identification of Sources

- Point
  - Human
  - Industrial
- Non-point
  - Fertilizer
  - Legumes
  - Manure
  - Mineralized soil N
  - Wet and dry deposition

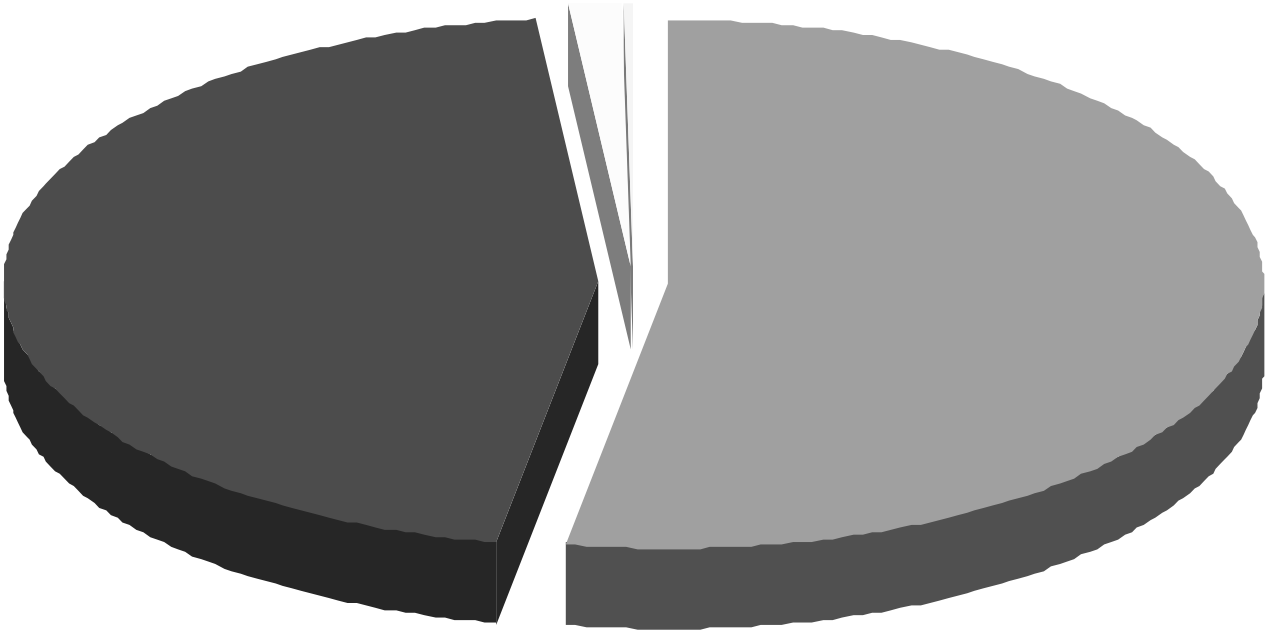
Estimated Point & Non-point Source Contributions to Stream N-Load



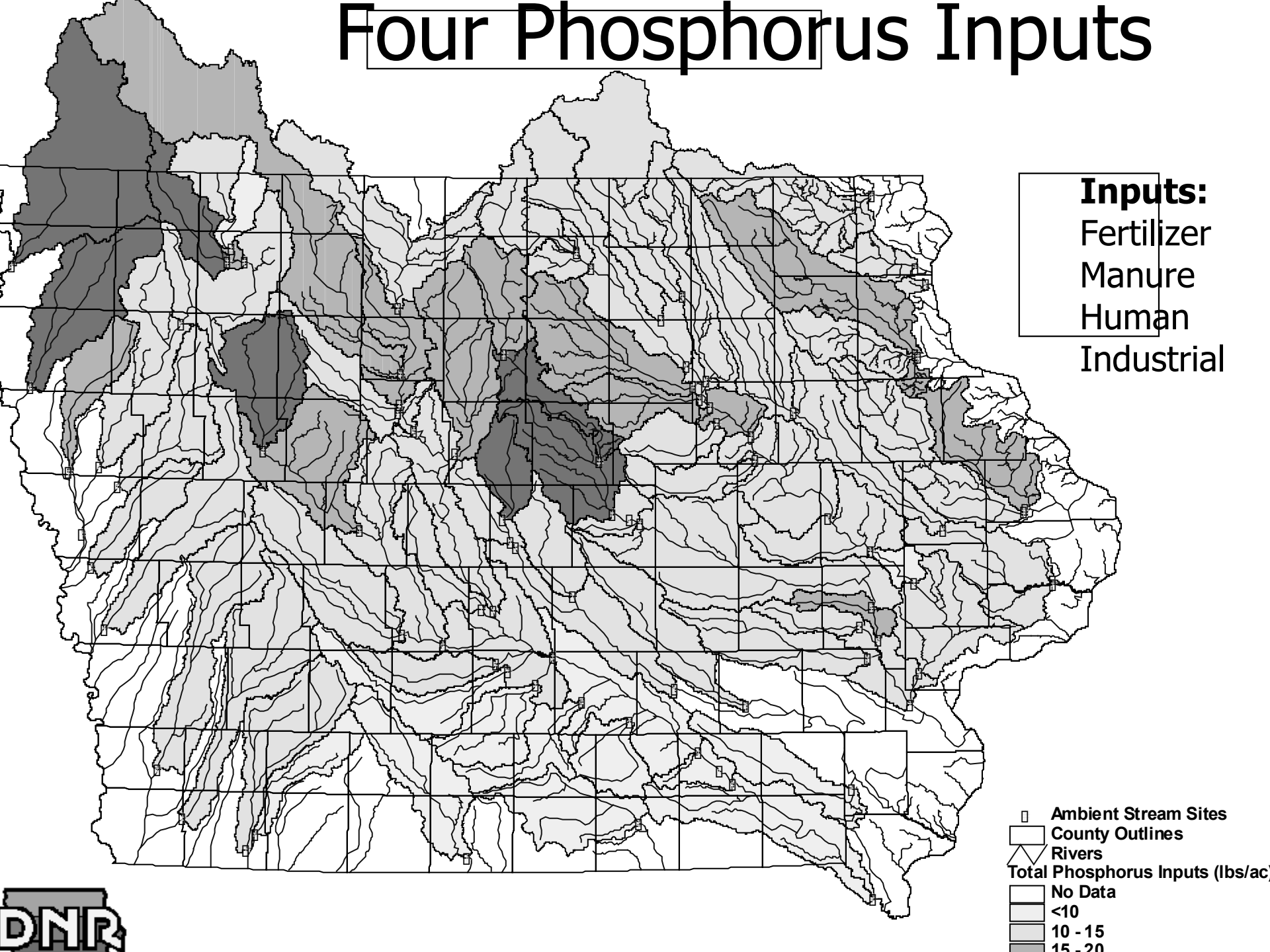
Nitrogen - preliminary results

- Large amount of nitrogen in watersheds; N released to water is a very small percentage of available N
- N level found in waters is related to total N inputs
- Point sources - 8% of N in streams
- Non-point sources - 92% of N in streams

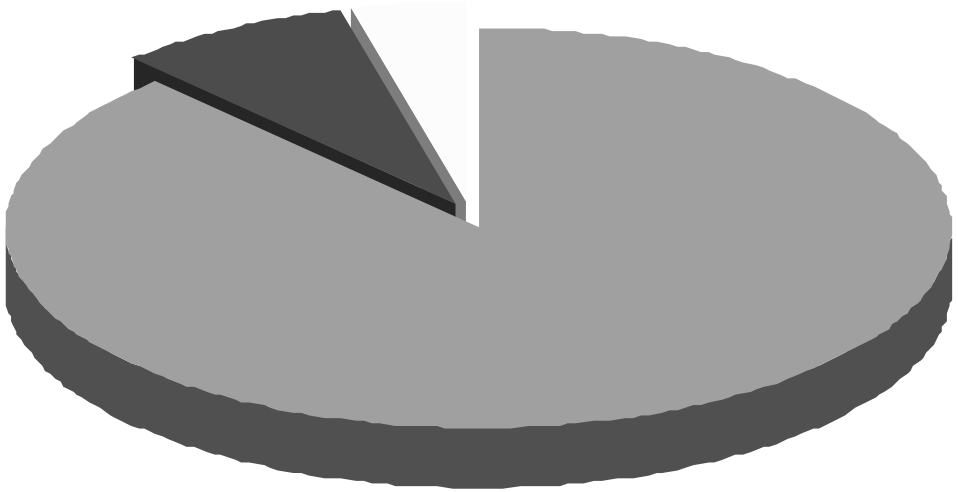
Phosphorus Inputs



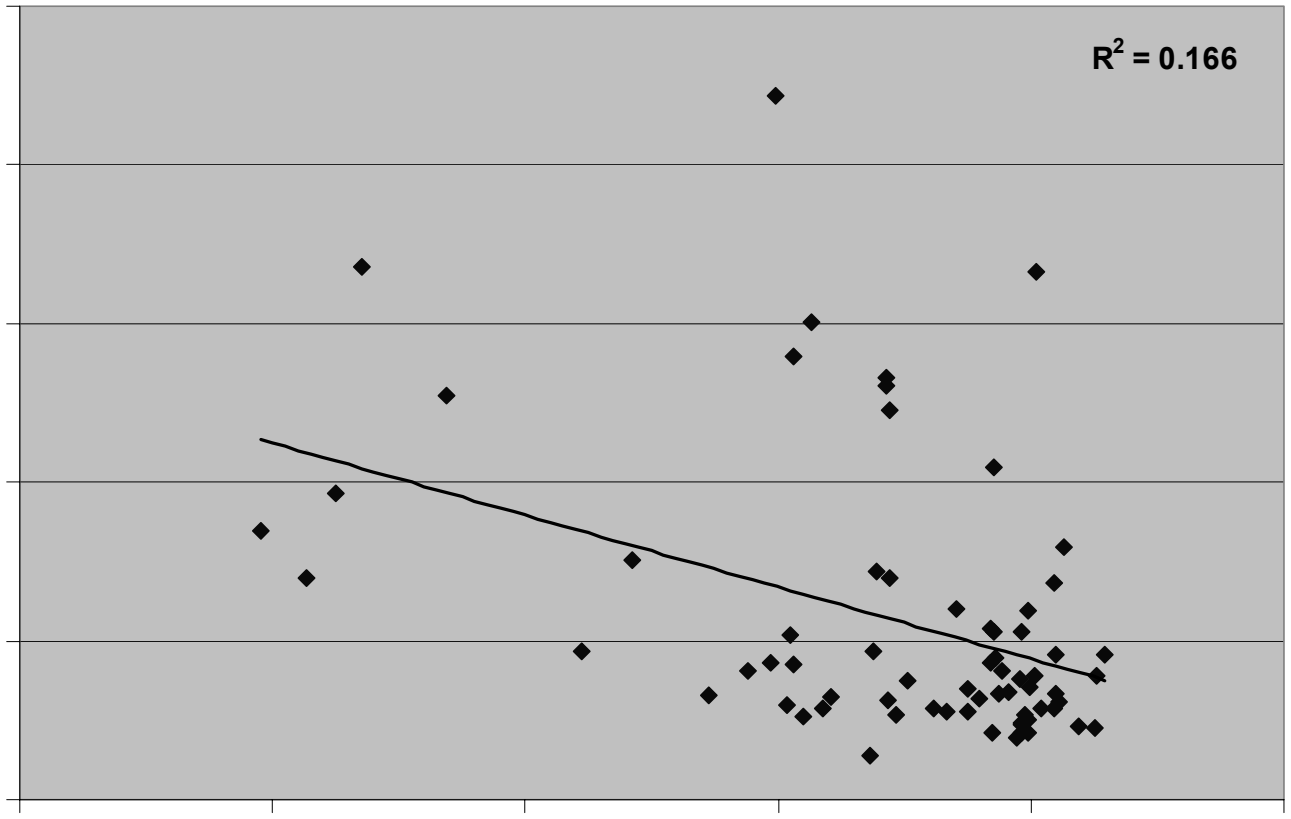
Four Phosphorus Inputs



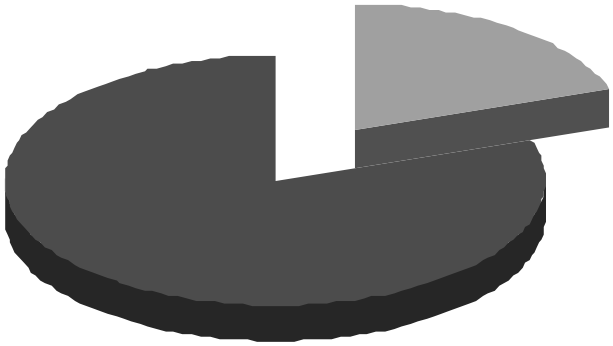
Phosphorus Outputs



Total P Input vs. Mean Flow Weighted Total P Concentration

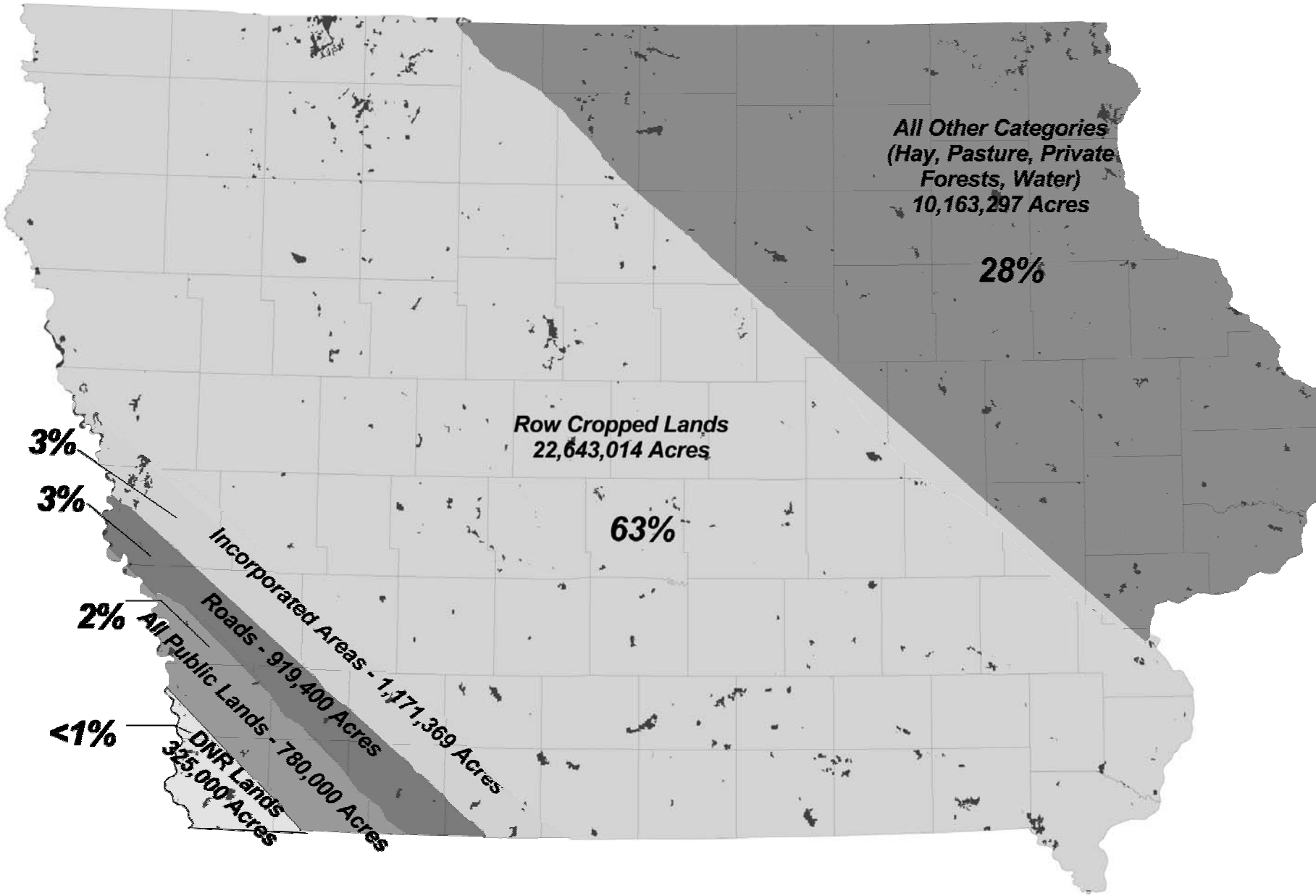


Estimated Point vs. Non-Point Contributions to Stream P-Load



Phosphorus - Preliminary Results

- Large amount of P in our watersheds; P released to water - a very small percentage of available P
- P input sources not correlated with water quality; water monitoring record not well suited for evaluation of Total P
- Point sources of P - 20% of total P in streams
- Non-point sources - 80% of total P in streams

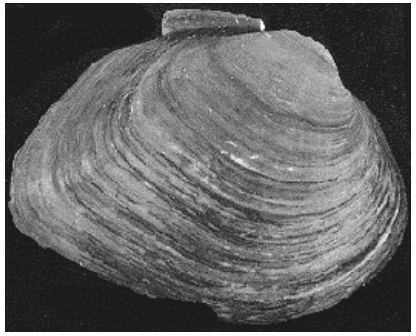

All Other Categories
(Hay, Pasture, Private
Forests, Water)
10,163,297 Acres
28%
Row Cropped Lands
22,643,014 Acres
63%
3%
Incorporated Areas - 1,171,369 Acres
3%
Roads - 919,400 Acres
2%
All Public Lands - 780,000 Acres
<1%
DNR Lands
325,000 Acres

Nutrient Strategy

- A huge issue for Iowa; requires unprecedented commitment to solve
- Agriculture is a significant contributor of nutrients; must be serious partner in identifying and implementing solutions
- Urban sources important locally; urban sources need to maintain and upgrade facilities (wastewater & stormwater)
- May require new approaches

Everyone Wants Clean Water

But what does "clean" mean?



Two tools for evaluating water quality

- Monitoring
- Water quality standards

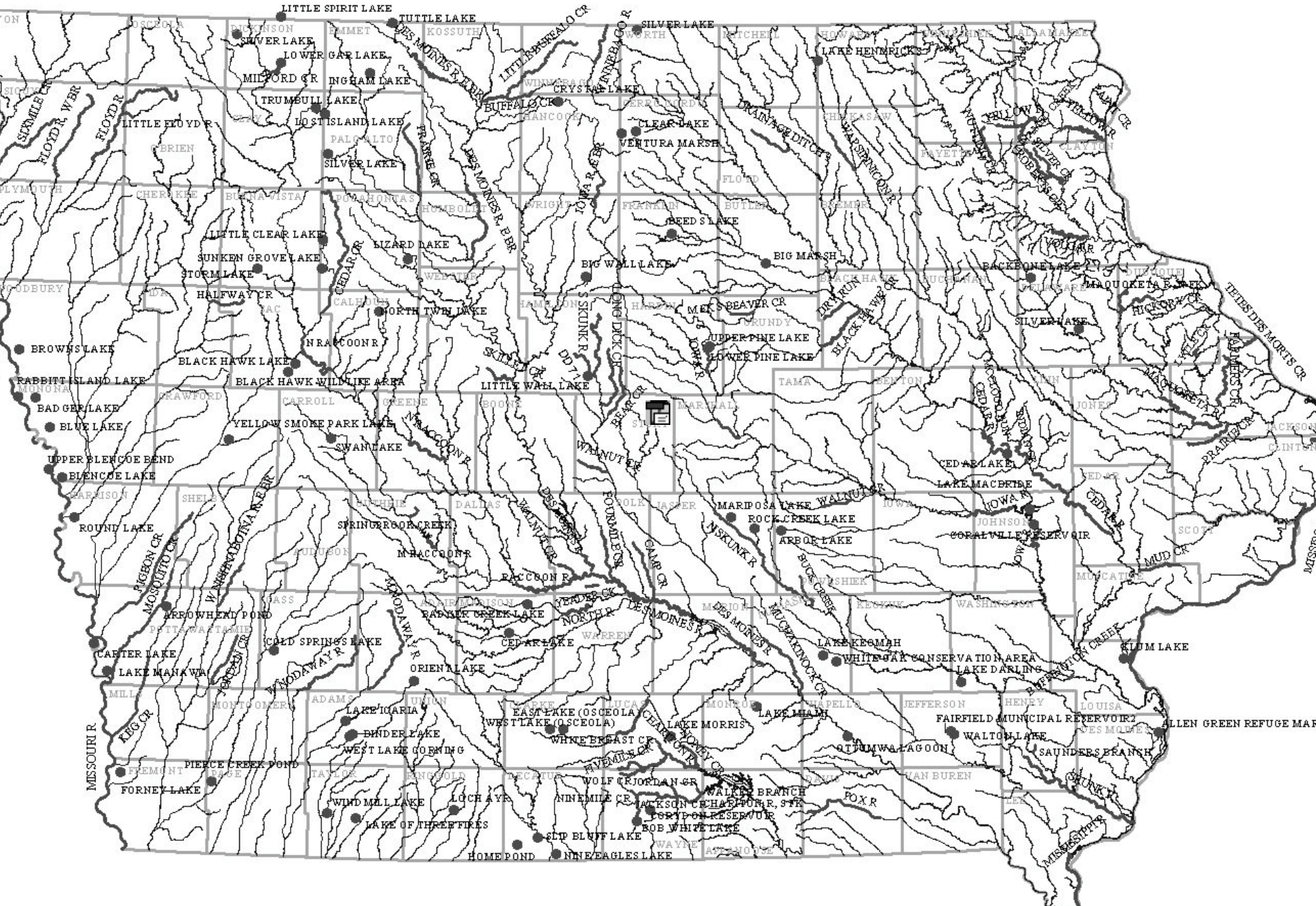
State Water Quality Standards

- Our “yardstick” used to measure water quality
- Monitoring results compared to standards
- Waters that do not meet all standards are considered *impaired*

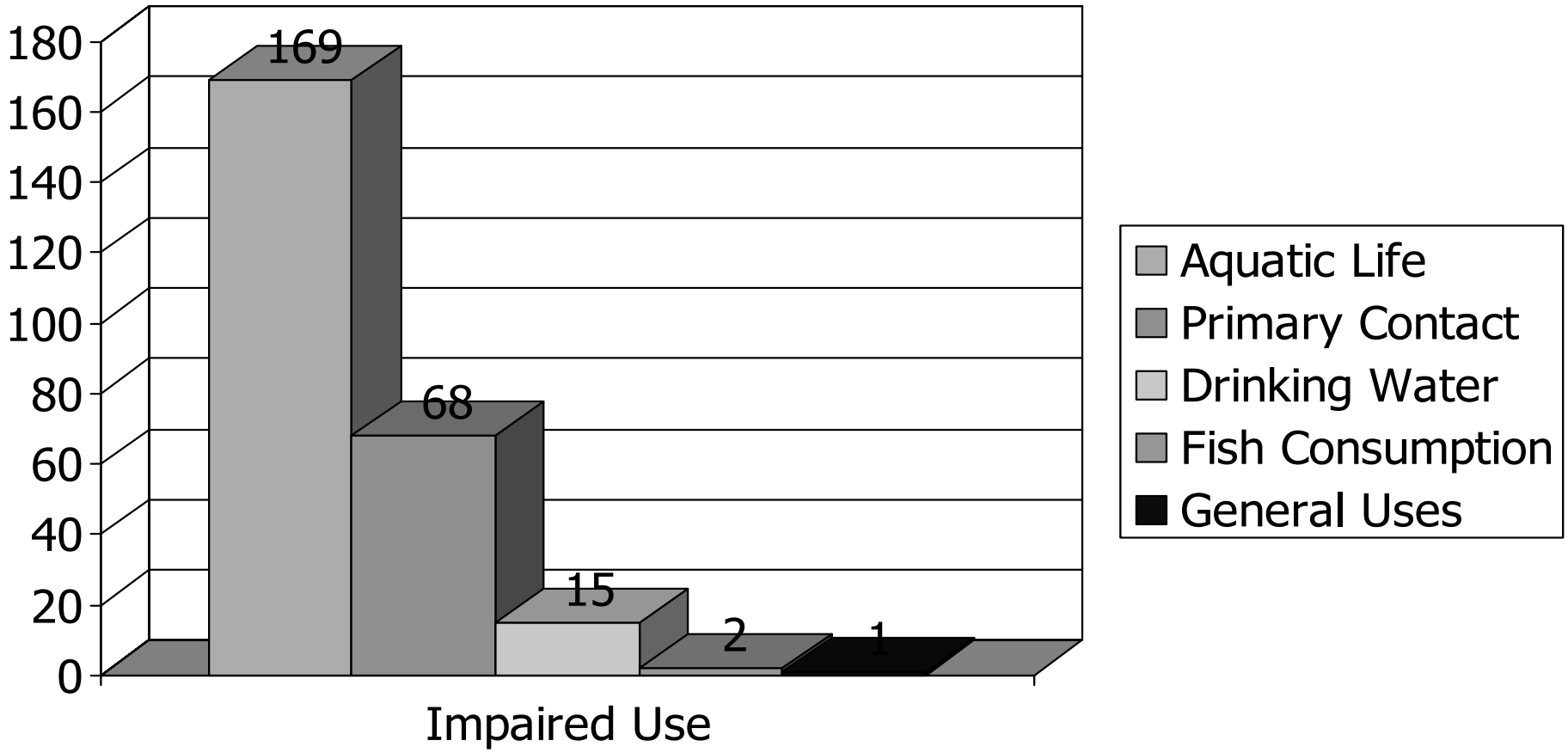
State Water Quality Standards

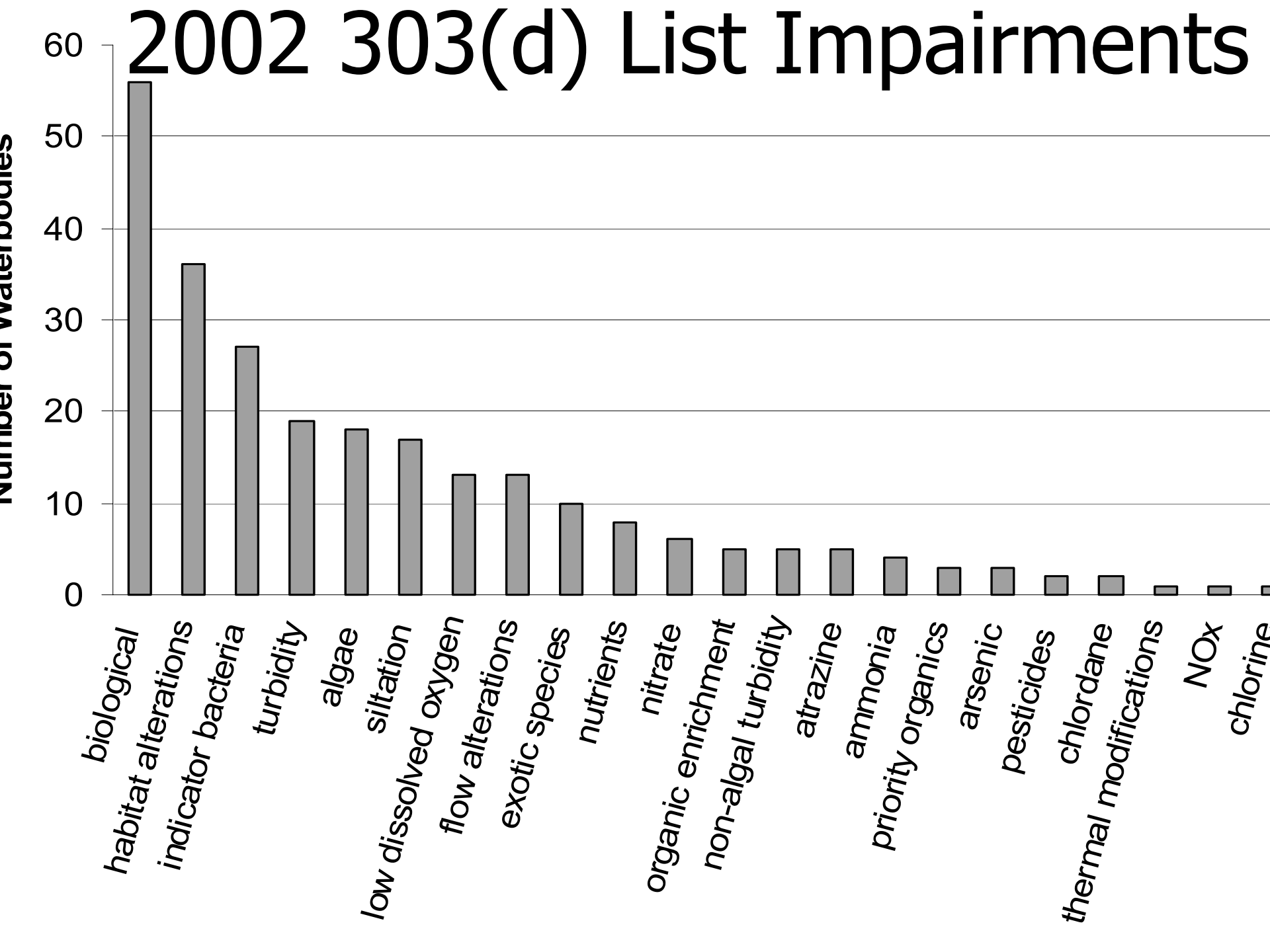
- Define levels of water quality needed for "swimmable, fishable, drinkable uses"
- Four elements:
  - Waterbody uses
  - Narrative standards
  - Numeric standards
  - Antidegradation policy

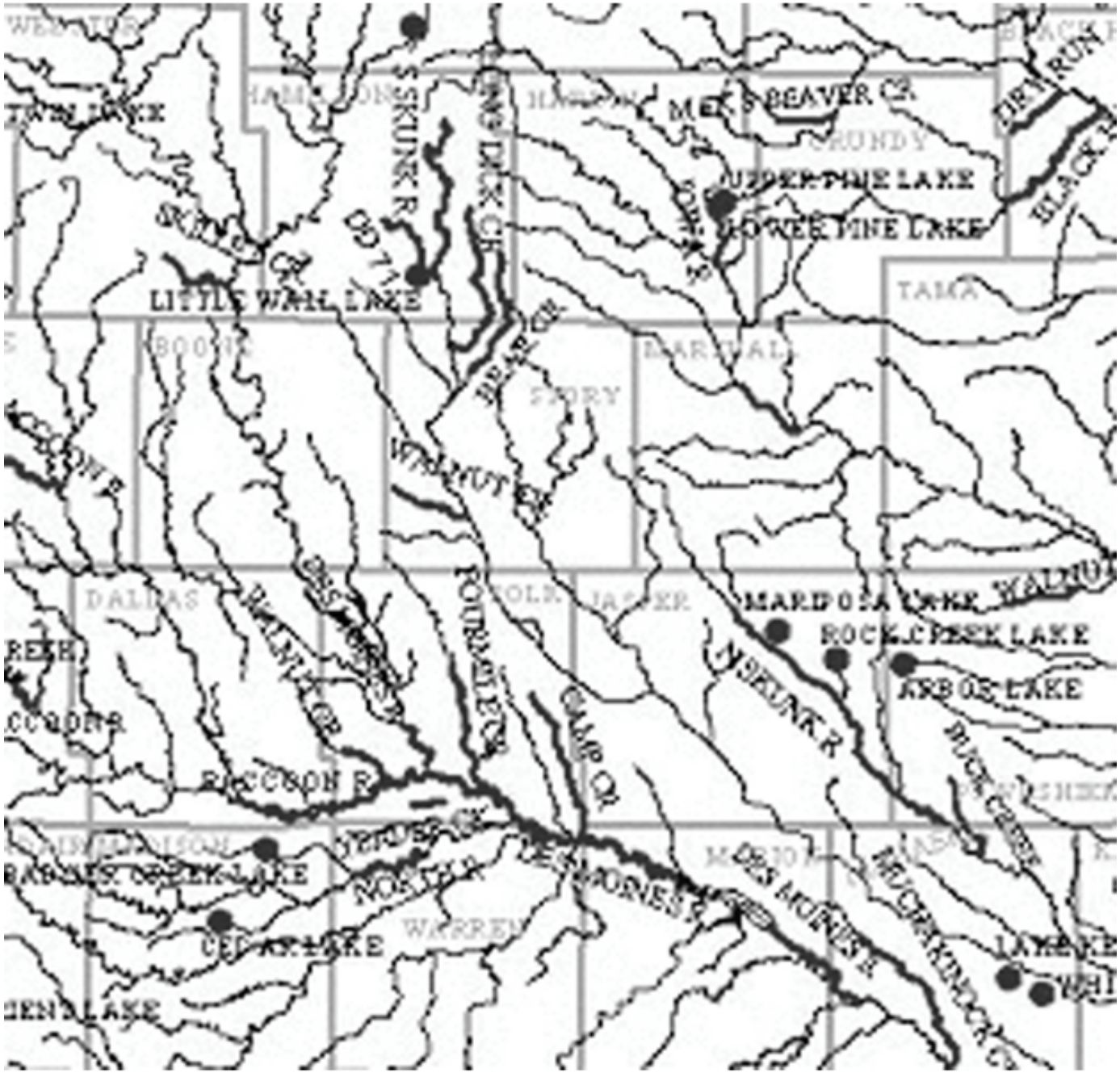
002 Section 303(d) - Impaired Waters



2002 Impaired Beneficial Uses




2002 303(d) List Impairments
Number of Waterbodies
60
50
40
30
20
10
0
biological
habitat alterations
indicator bacteria
turbidity
algae
siltation
low dissolved oxygen
flow alterations
exotic species
nutrients
nitrate
organic enrichment
non-algal turbidity
atrazine
ammonia
priority organics
arsenic
pesticides
chlordane
thermal modifications
NOx
chlorine



● 303(d) Lake or Wetland

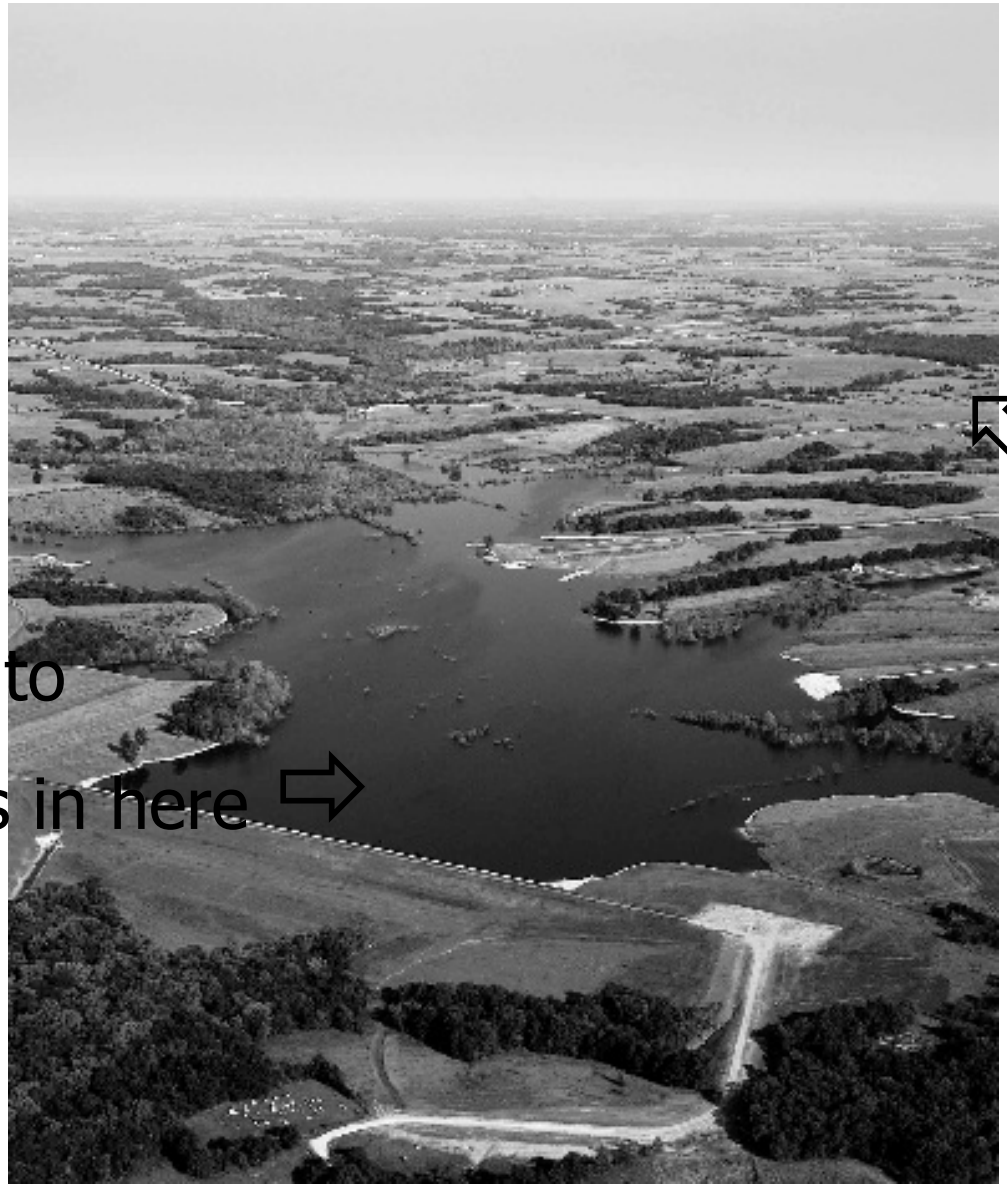
303(d) River or Stream Segment

Fixing our impaired waters

…and improving the quality of all waters

Water quality is very much a land use issue

Watershed Management: The Key to Water

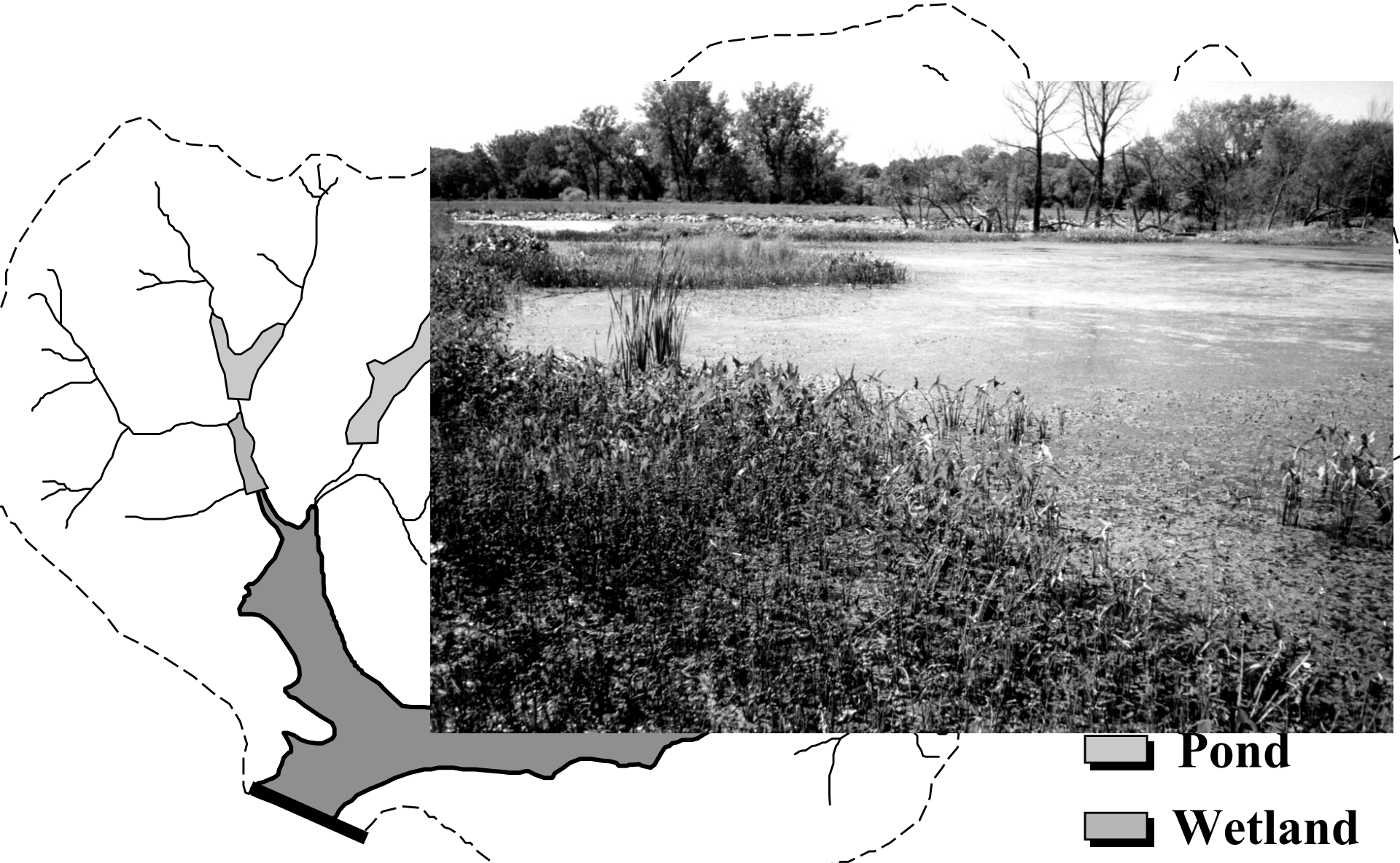


Look up here

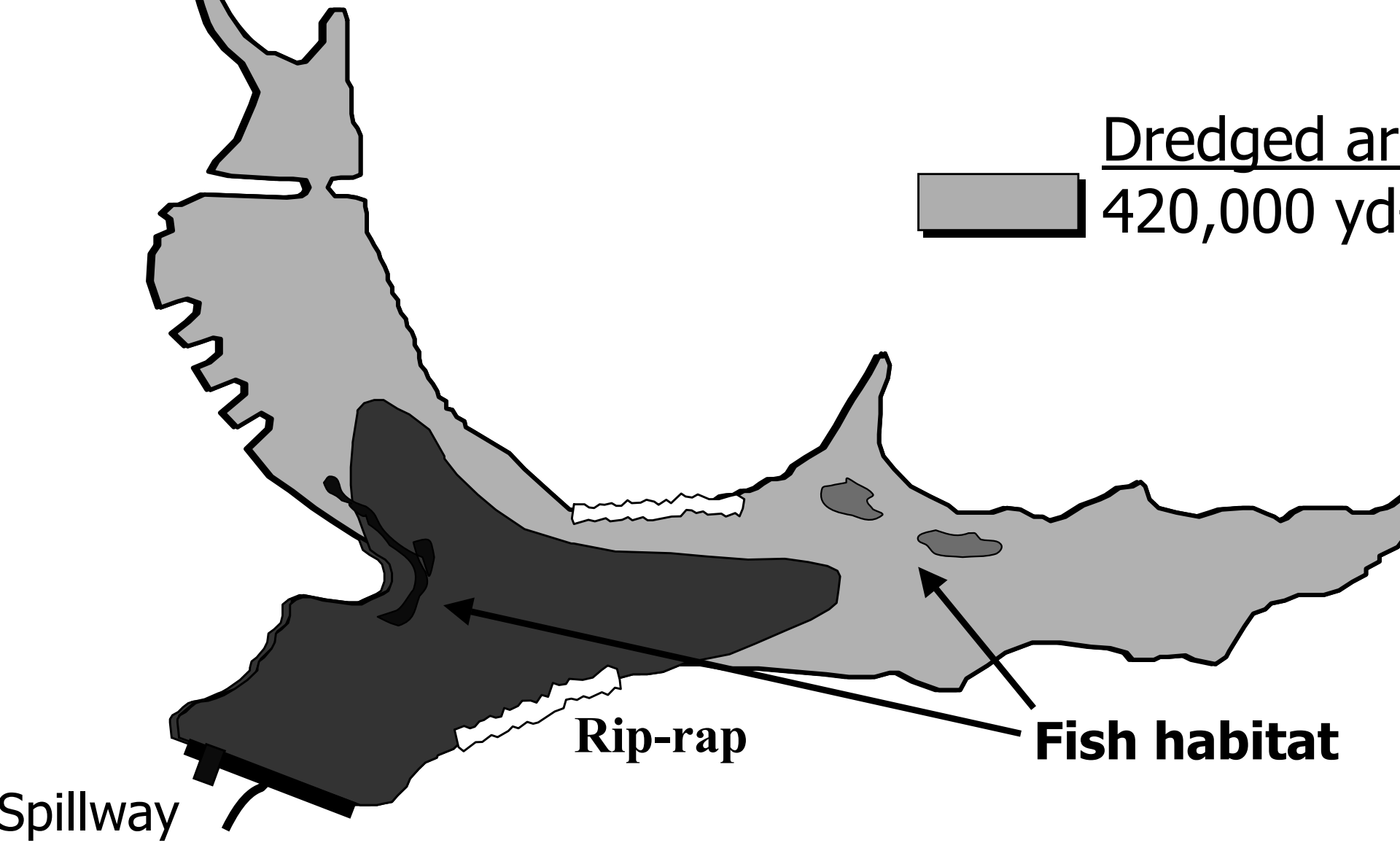
If you want to know what's in here

Solutions to Water Quality Problems Start on the Landscape

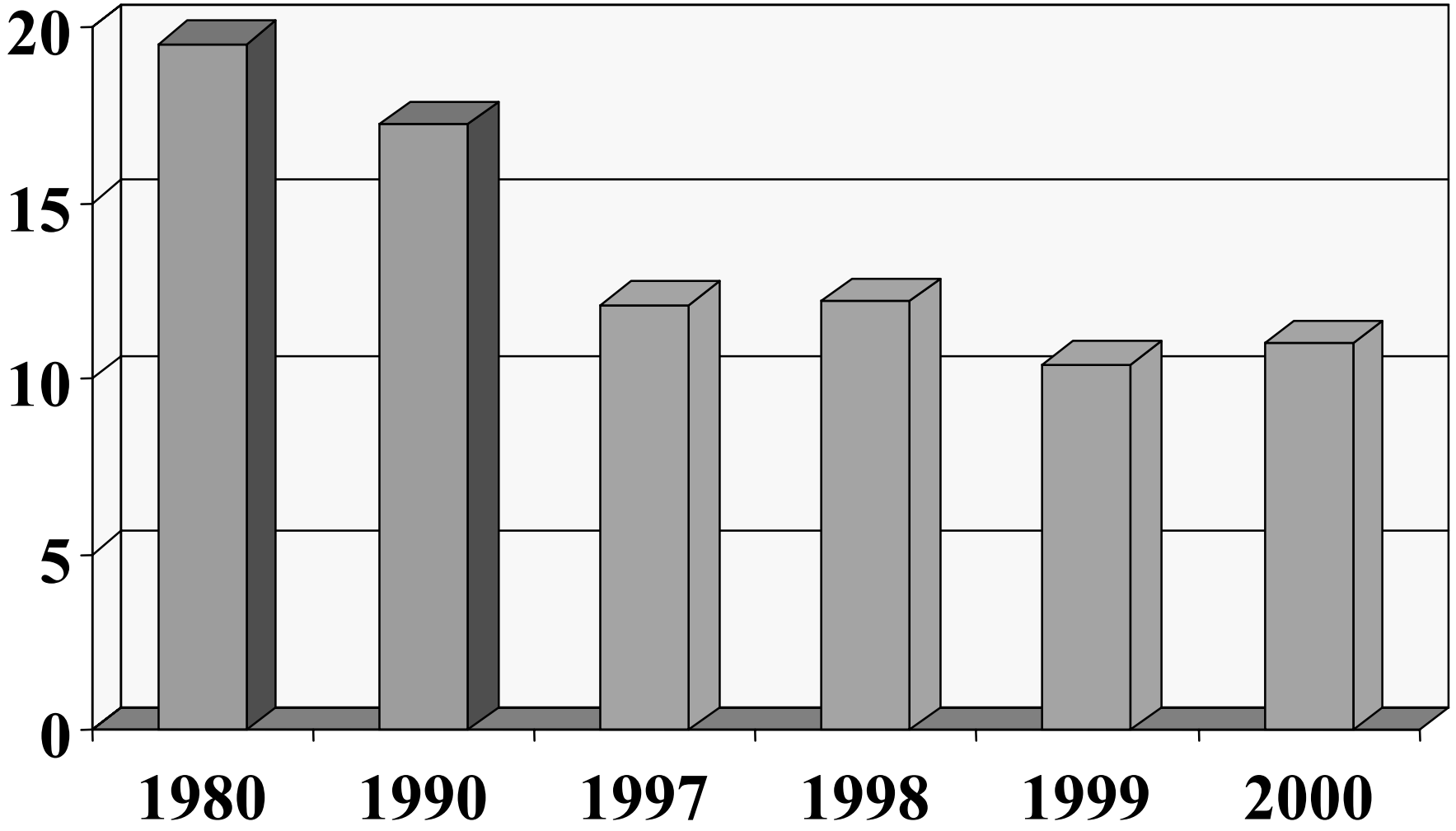
Lake Anquabi - Watershed



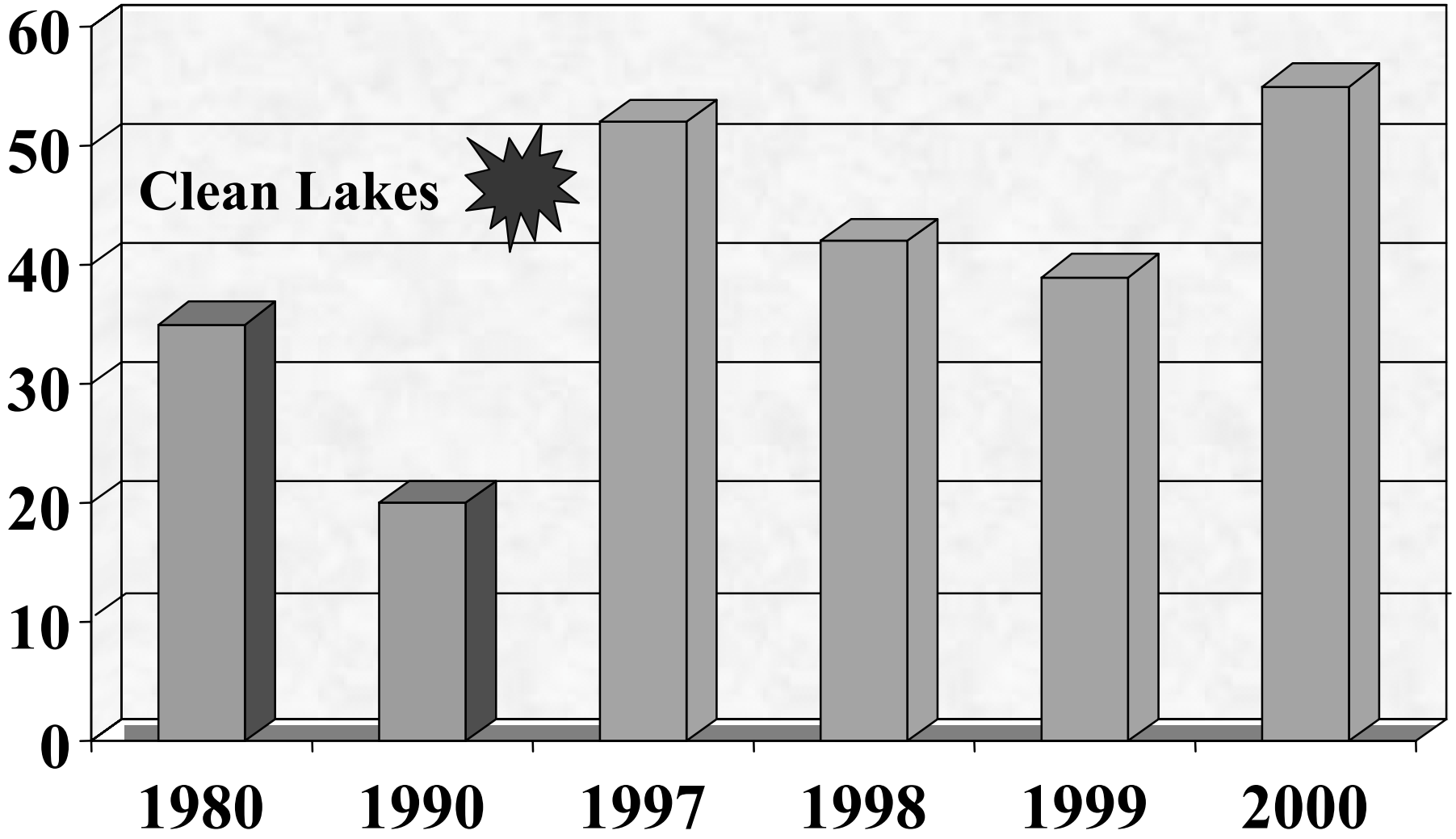
Restoring – Improving Water Quality - Lake Ahquabi



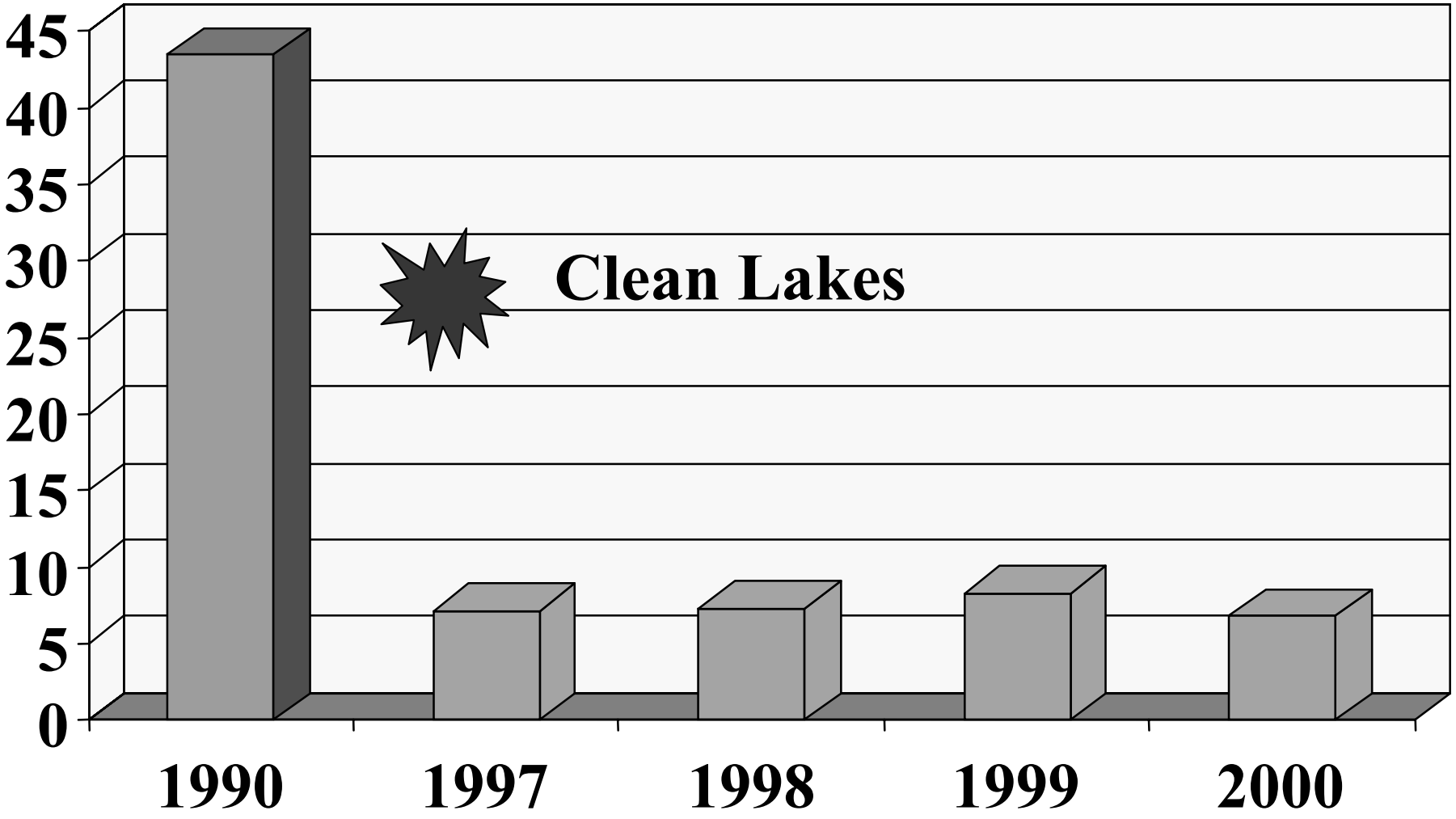
Chlorophyll a (ug/L)



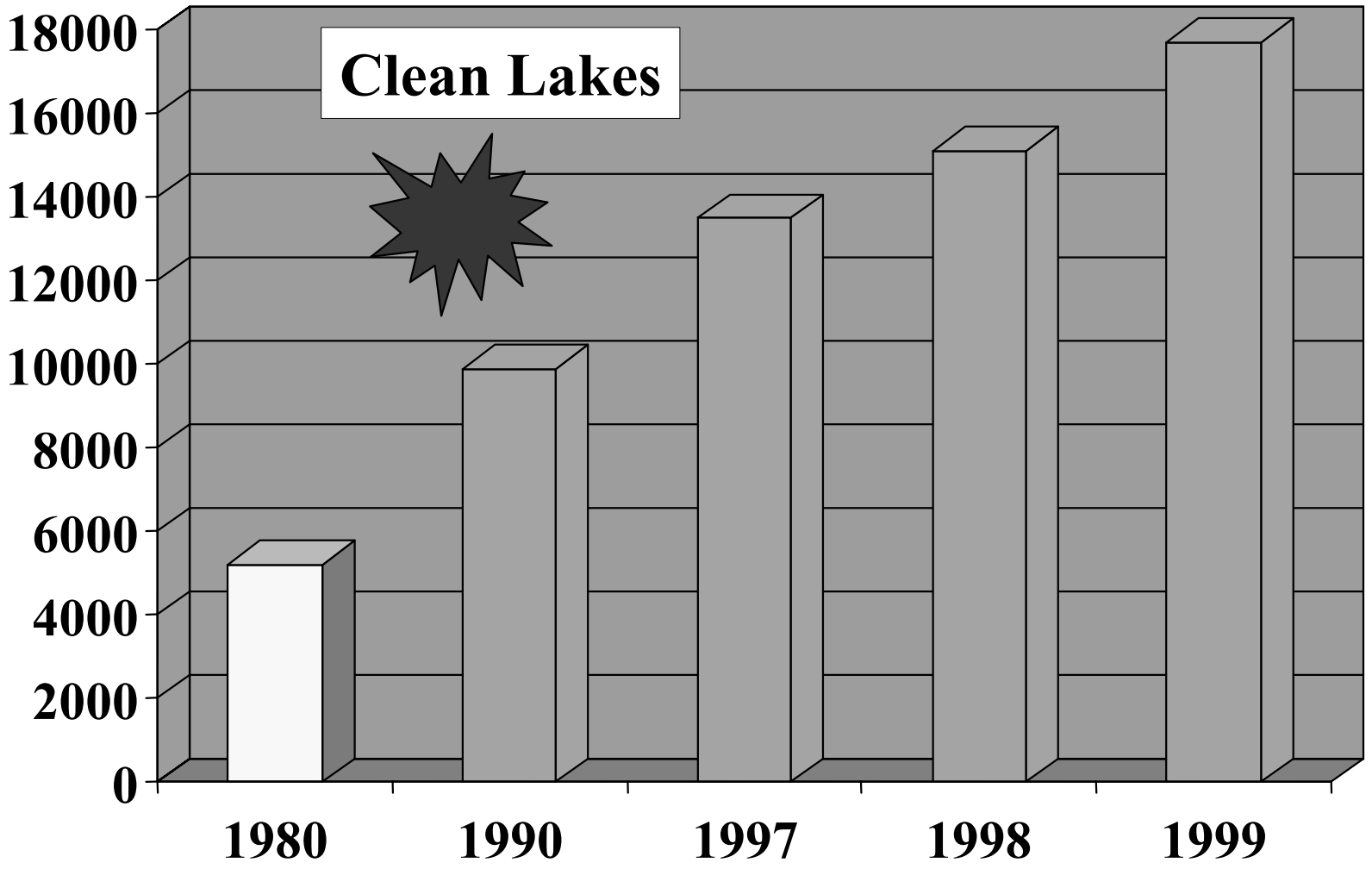
Secchi Disc Depth (inches)



Total Suspended Solids (Mg/l)



Fishing Trips



What we learned from Ahquabi

Water quality improvement can be considered a sound investment for Iowa. After renovation was completed

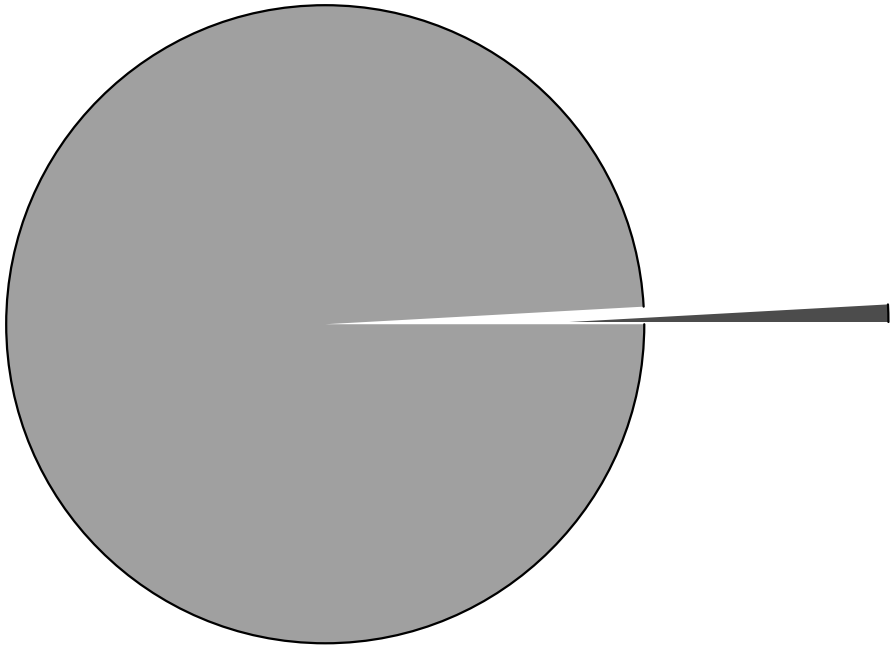
- More people use the lake
- Park use increased - 60,000 to 356,000 visitor days/year
- Increased park visitation yields a “payback” in only two years for the original $4 million cost of the project

There are many programs in place to improve water quality

- Regulatory (for instance NPDES permits)
- Incentives (for instance, wetland reserve program)
- Technical assistance
- BUT:

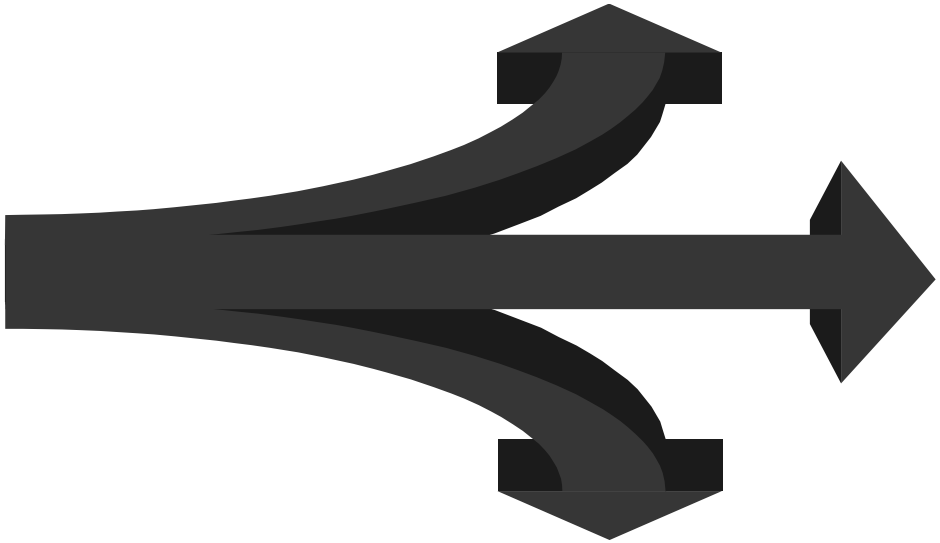
Now the kicker ...

Less than 1 percent of Iowa's overall general fund is spent protecting and improving our natural resources



It’s time to make a decision!

Continue as we have and hope for the best.

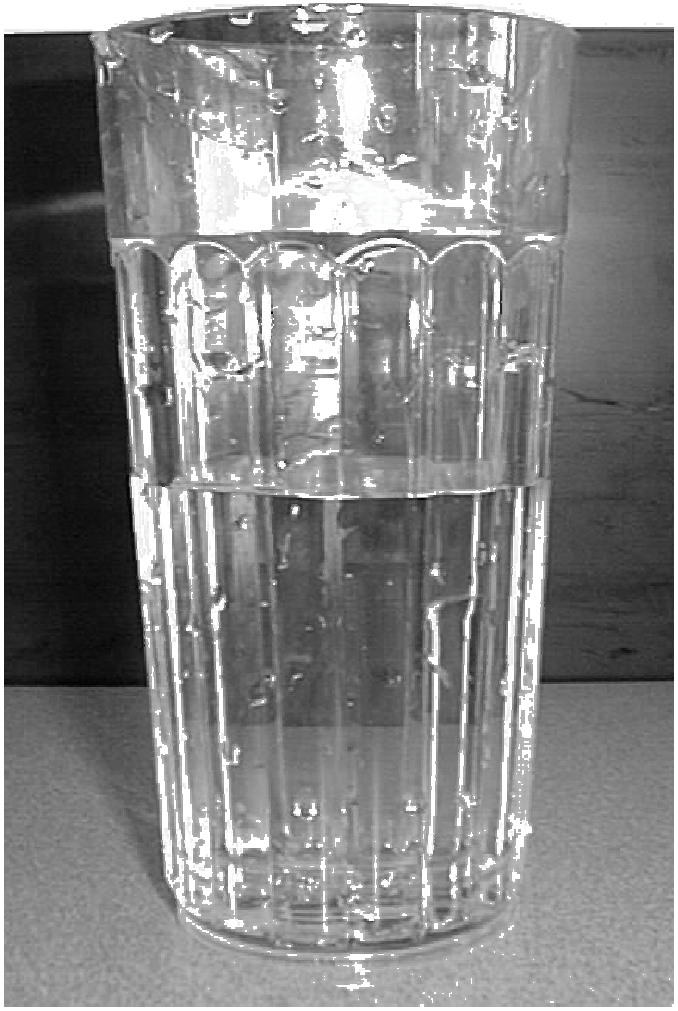


Same approach, but more resources for planning, assistance and implementation.

A new approach?

Half Full? Or Half Empty?

Regardless of your opinion …

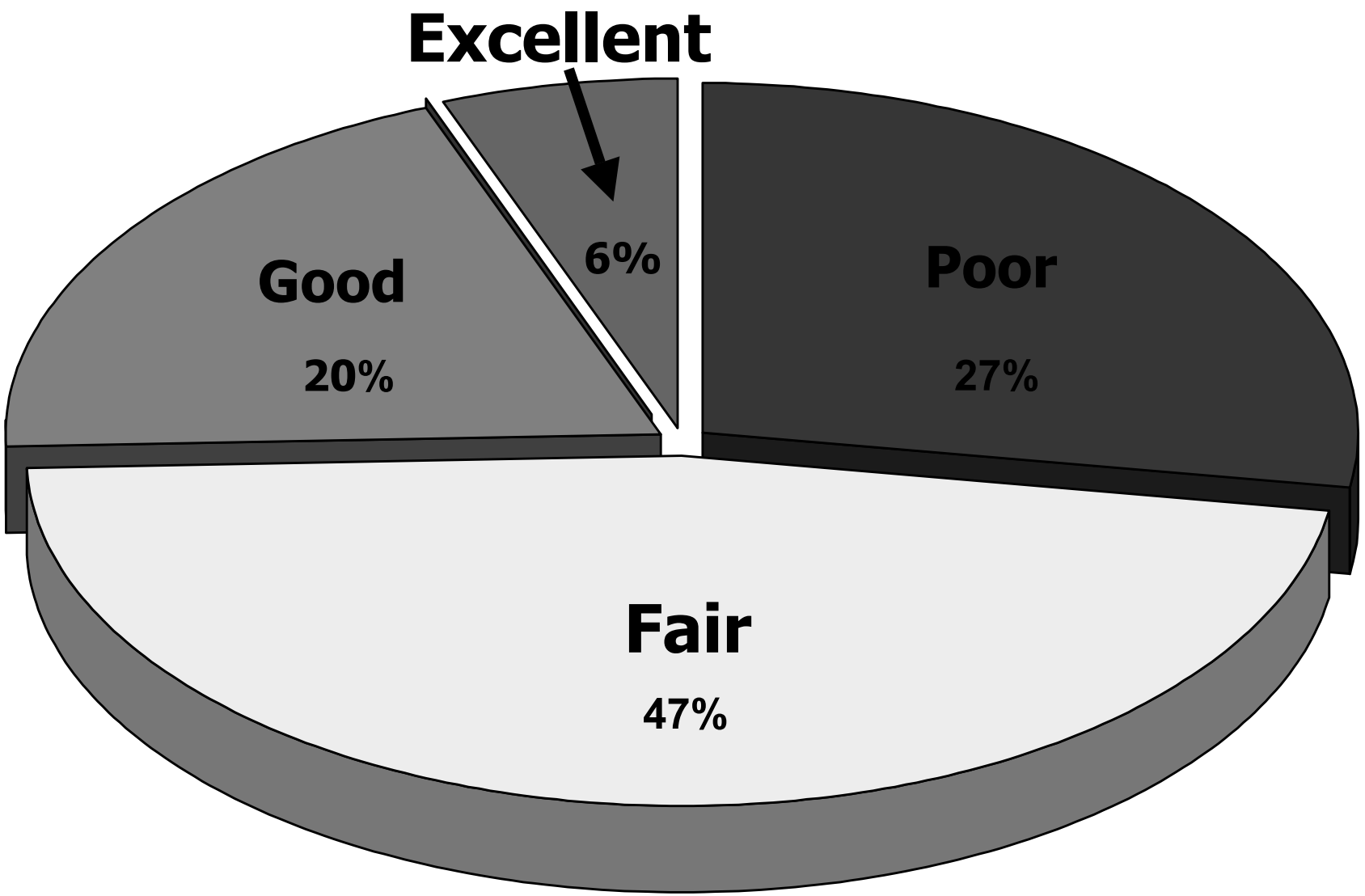


We all agree it can be fuller

2002 Random Sampling Project

51 Stream/River Sites

Fish Index of Biological Integrity



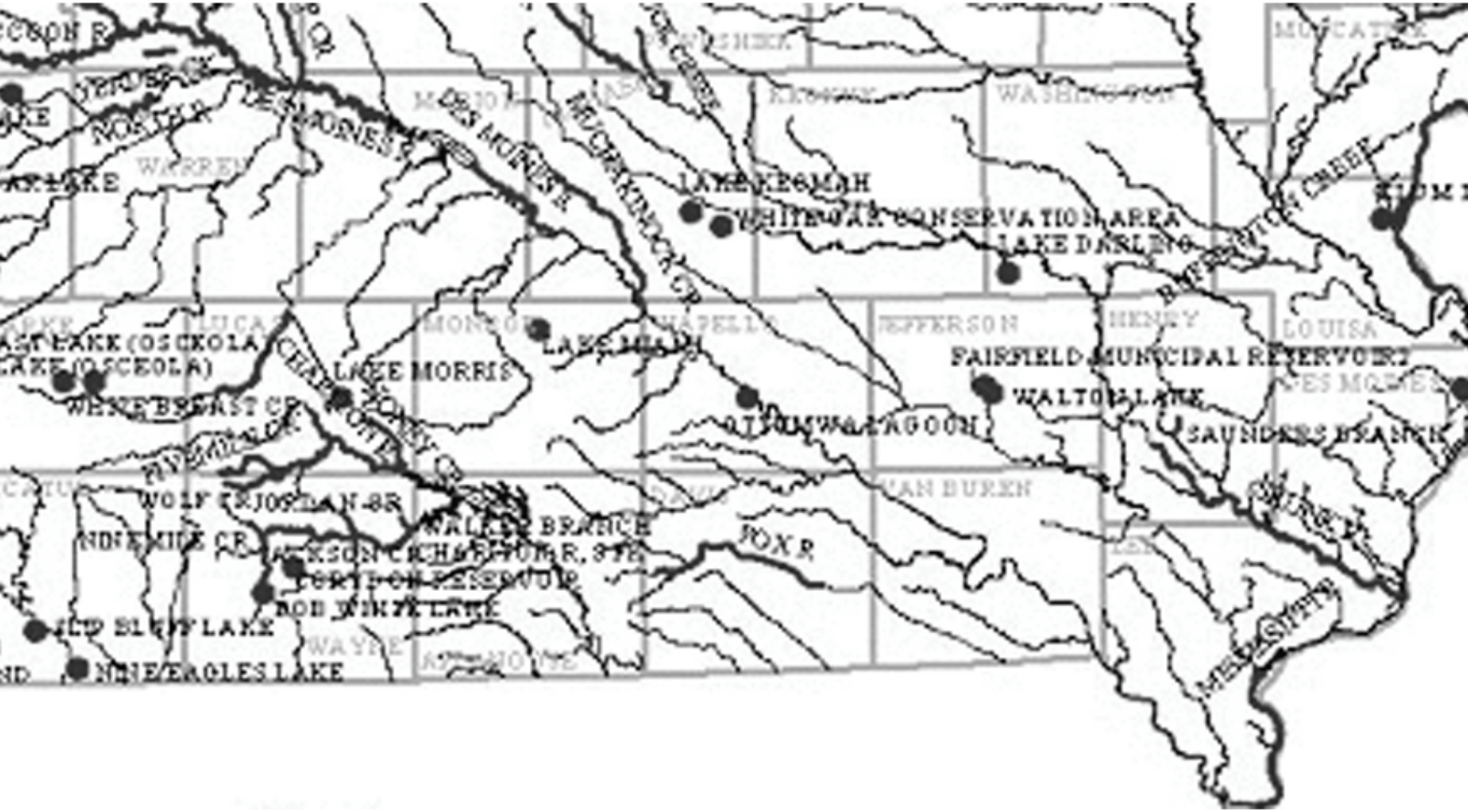
Water Quality - One of Governor Vilsack's Top 5 Priorities

Water Summit – November 24

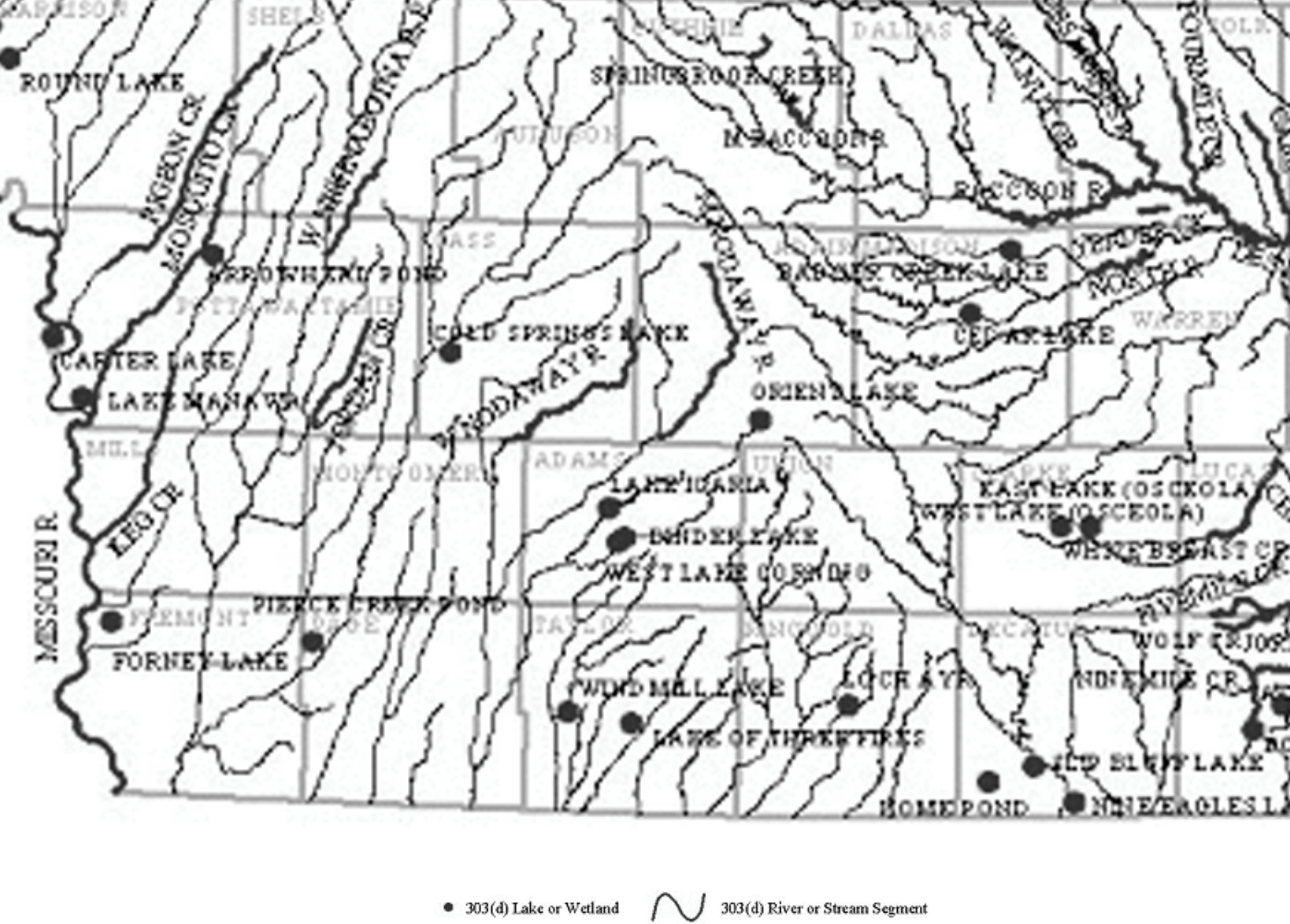
Scheman Auditorium, Ames, Iowa

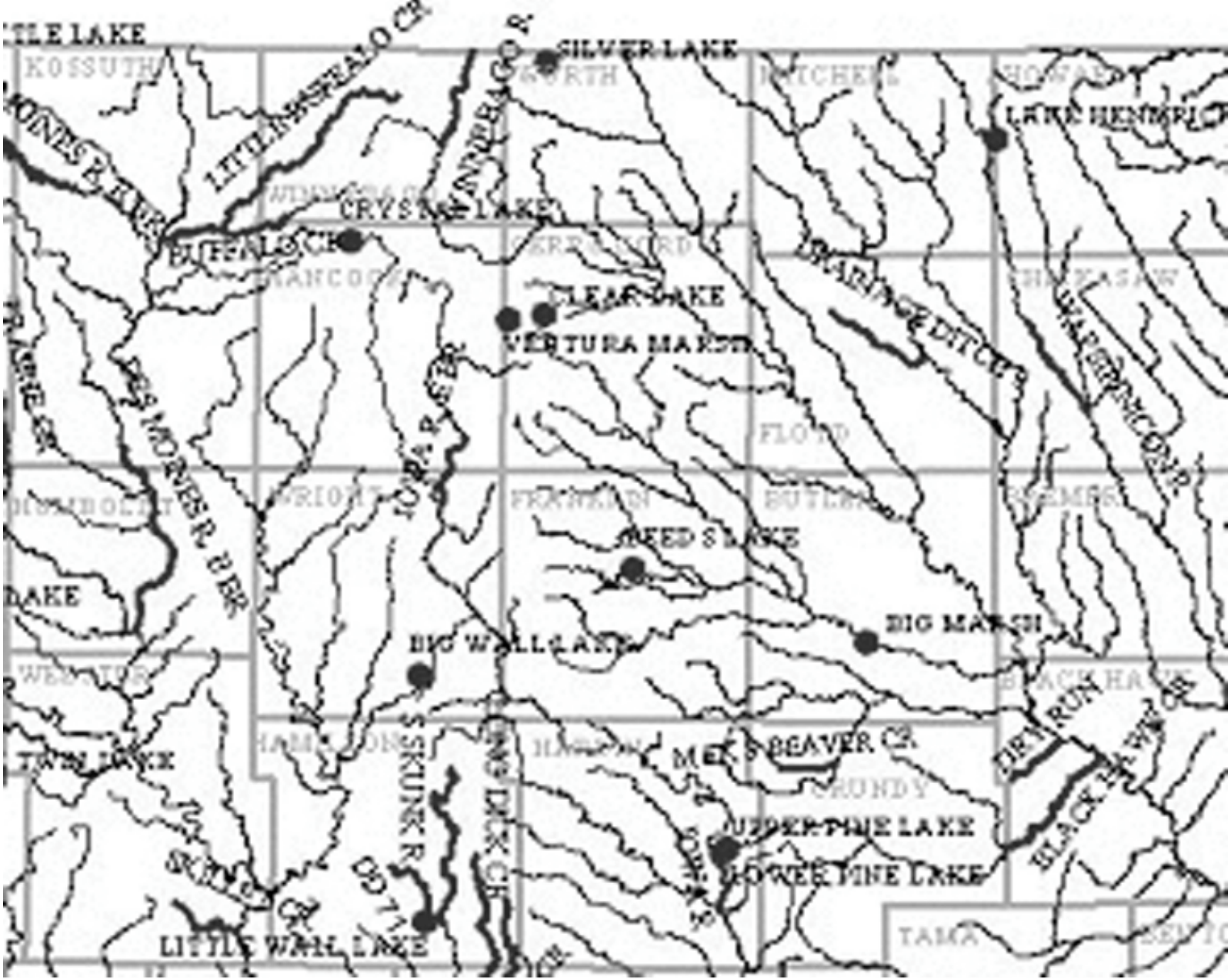
For information, www.iowadnr.com

Send written comments to
water.summit@dnr.state.ia.us

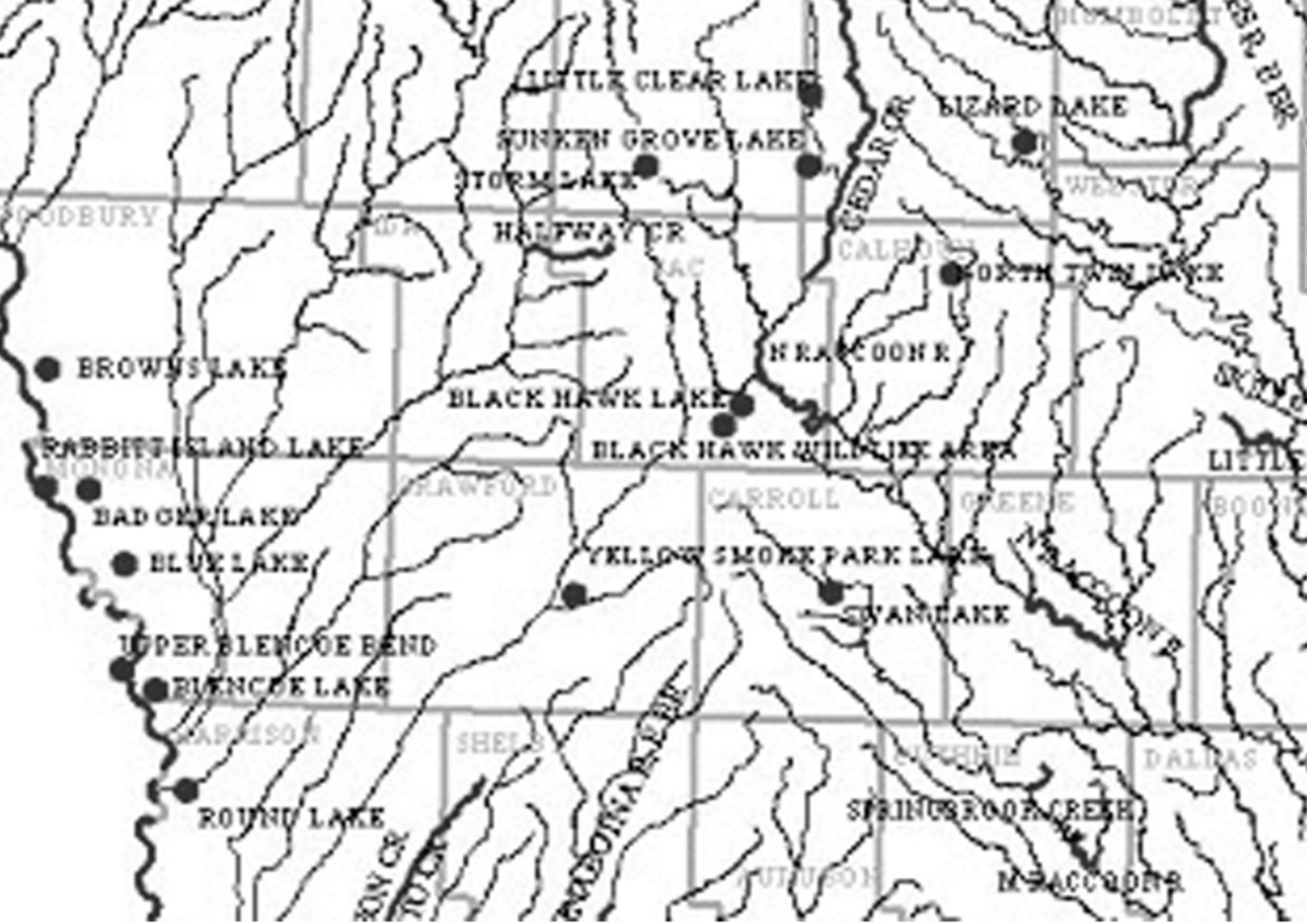


● 303(d) Lake or Wetland ~ 303(d) River or Stream Segment


ROUND LAKE
SPRINGBROOK CREEK
MACCOON
RACCOON R.
PIGEON CR.
MOSQUITO CR.
W. NISHNABOTNA R.
NISHNABOTNA R.
BADGER CREEK LAKE
CARTER LAKE
LAKE MANAWA
COLD SPRINGS LAKE
OTTER CR.
OTTER CR.
ODEN LAKE
LAKE IDAHA
EAST LAKE (OSCEOLA)
WEST LAKE (OSCEOLA)
WEST BRANCH
LEO CR.
MISSOURI R.
WEST LAKE (SHELBY CO.)
PIERCE CREEK POND
FORNEY LAKE
WOLF CR.
WOOD MILL LAKE
LAKE OF THREE FIRES
INDIAN CR.
HOME POND
NINE EAGLES L.
303(d) Lake or Wetland
303(d) River or Stream Segment



● 303(d) Lake or Wetland ∼ 303(d) River or Stream Segment



● 303(d) Lake or Wetland

303(d) River or Stream Segment

● 303(d) Lake or Wetland ∿ 303(d) River or Stream Segment

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